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Original Communications

NORMAL VARIATIONS IN TYPE OF THE FEMALE PELVIS AND THEIR OBSTETRICAL SIGNIFICANCE

BY JOHN T. WILLIAMS, M.D., F.A.C.S., BOSTON, MASS.

IN 1543, less than four hundred years ago, Andreas Vesalius gave the first correct anatomical description of the normal pelvis. Eighteen years later his pupil, Arantius, first recognized the existence of contracted pelves. Two hundred and thirty more years elapsed before Baudelocque, in 1789, invented the pelvimeter and put the study of the pelvis in the living woman upon a scientific basis. Scientific obstetrics may be said to date from this invention, although the study advanced so slowly that it was not until 1861, seventy-two years later, that Litzman published the first classification of pelves based upon form as well as size. It is not remarkable, therefore, that, since the recognition of gross abnormalities developed so slowly, the study of variations in the normal pelvis should have received little attention. Ethnologists have long been familiar with variations in the form of the pelvis in different races, but since from an obstetrical standpoint we are concerned mainly with women of the white race, I shall not refer further to such racial differences.

The rarity of deformed pelves in white American women has been remarked by a number of observers. Reynolds[1] found only 1.34 per cent of contracted pelves in 2,227 women, but as he measured the pelvis in those cases only in which dystocia occurred, we must regard his figures as too low. Flint[2] found 8.46 per cent of contracted pelves in 10,233 women delivered by the New York Lying-in Hospital. Williams[3] found, in Baltimore, 8.49 per cent of contracted pelves among 2,178 white women. Among the 300 primiparous women upon whom

the study of this paper is based I found 27 in whom I felt the measurements were small enough and the disproportion between the pelvis and fetus great enough to demand cesarean section for mechanical reasons alone. In the majority of these the pelvis was perfectly normal in shape but of small size.

The normal female pelvis, as described in all textbooks of anatomy or obstetrics, presents the following characteristics: the bones are lighter and thinner than in the male. The flare of the ilia is greater resulting in broader hips. The superior strait is elliptical and wider in all its diameters than is the case in the male. The pelvic outlet is wide in the female and the descending rami of the os pubis form an arch rather than an angle. According to Dieulafé[4] the arch in the female intercepts an arc of from 70 to 100 degrees, while in the male the rami form an angle of always less than 70 degrees. The outlet is therefore wider in all its diameters in the female than in the male. The sacrosciatic notch is also wider in the female. The obturator foramen is more triangular in the female and more oval in the male. Quain[5] gives the following average measurements from a number of full sized male and female pelves:

	MALE	FEMALE
Intercristal diameter	28.6 cm.	31.9 cm.
Interspinous diameter	24.1 "	25.0 "
External conjugate	18.4 "	18.0 "
Transverse of outlet	8.8 "	12.1 "
Anteroposterior of outlet	8.5 "	10.8 "

J. Whitridge Williams[6] gives the following internal measurements:

	MALE	FEMALE
Superior Strait.		
Anteroposterior	10.5 cm.	11.0 cm.
Transverse	12.5 "	13.5 "
Oblique	12.0 "	12.75 "
Inferior Strait.		
Anteroposterior	9.5 "	11.5 "
Transverse	8.0 "	11.0 "

With the development of the study of the pelvic outlet by Williams, Thoms and others, the great frequency of pelves with small outlet measurements became recognized. Thoms[7] found that 5.3 per cent of 4000 consecutive patients at the Johns Hopkins Hospital had contractions of the pelvic outlet. Williamson,[8] in New York, found outlet contraction in 7.7 per cent of 1,579 cases at the Manhattan Maternity Hospital. These figures include only those cases in which the transverse diameter of the outlet was 8 cm. or under. If all cases where the diameters of the outlet were less than those given by Quain or Williams had been included the percentages would have been considerably higher.

Two explanations have been advanced for the occurrence of outlet

contractions in women. J. Whitridge Williams[9] believes the majority of them to be due to assimilation of the fifth lumbar vertebra with the sacrum. This results in a higher articulation of the ilium with the spinal column which causes the ischia to converge. He was able to confirm this mechanism in a number of patients by palpating six sacral vertebræ. On the other hand, this explanation does not hold good for all cases. I have had several cases of outlet contraction x-rayed in which the sacrum showed definitely only five segments.

Berry Hart[10] explains the incidence of contractions of the pelvic outlet by what he describes as inversion of certain parts of the female pelvis to the male type. He differentiates two forms of inversion, an iliosacral and an ischiopubic type. In the iliosacral form the ilium and sacrum invert to the male type resulting in contraction at the superior strait. In the ischiopubic inversion the outlet is contracted; the pubic arch is angular, and the ischia close together as in the male pelvis. Hart's views are based upon the examination of one autopsy and seven museum specimens.

Impressed in the course of routine antepartum examinations by the large number of contracted outlets found in women with broad hips and large external measurements, I found after a time that I could predict almost with certainty that when the external measurements exceeded 30 cm. in the intercristal, and 20 cm. in the anteroposterior, the transverse diameter of the outlet would be more or less contracted and the pubic arch angular. On the other hand, in women with measurements which did not exceed 20 cm., 25 cm., and 28 cm. for the external conjugate, the interspinous and intercristal diameters, respectively, I could with equal certainty predict a wide arch and an ample transverse diameter of the outlet. These observations led me to believe that there are two distinct types of female pelvis both of which must be regarded as normal. Further study has revealed other characteristics of both types which I shall enumerate.

The more common type corresponds rather closely with the ordinary textbook description of the normal female pelvis. The external measurements are normal or often slightly below normal. An external conjugate of 18 cm. or 19 cm. is not uncommon and from the usual course of labor in these pelves must be regarded as within normal limits. The intercristal is almost never over 28 or 29 cm. The pubic arch is wide and the transverse diameter of the outlet ample. The bones are thin and internal examination gives a sense of roominess. The os pubis is vertical or nearly so, and its vertical diameter is short. The general development of the patient is in keeping with the form of the pelvis. The entire skeleton is lighter than in the other type. This type of pelvis is more commonly found in slender women, although it may be found in obese subjects. The perineum is usually

elastic and not particularly thick or muscular. For purposes of designation, I shall call this the feminine type of pelvis.

The other, which is also the less common type of pelvis is, as I have indicated, characterized by broad external measurements and a narrow outlet. The external conjugate varies from 21 cm. to 23 cm., the interspinous from 26 cm. to 28 cm., and the intercristal diameter from 30 cm. to 32 cm. The pubic arch is narrow and the ischia close together. The bones are usually thicker and heavier than in the first type of pelvis. This is especially noticeable in the os pubis, which is considerably increased in height, and is horizontal rather than vertical so that its anterior surface is directed downward instead of forward. This is due in part to an increased pelvic inclination. The

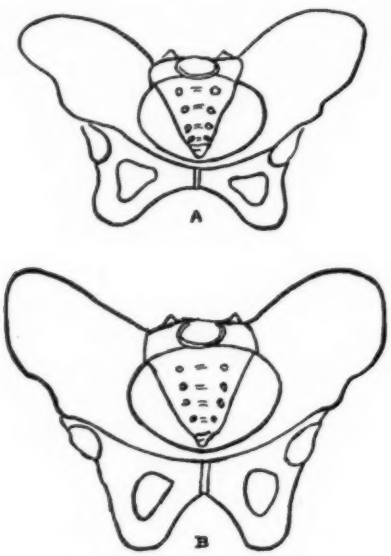

Fig. 1.—Feminine type above. Muscular type below. Purposely exaggerated to show differences. Note the wider pubic arch and lighter bones in the first type and the narrower outlet but wider hips in the second.

skeleton is heavier than in the type of pelvis first described. The patients are either large and muscular, usually obese, but with distinctly feminine type of figure, or short and thick set with heavy figures. The perineum is thick and muscular. I shall call this the muscular or heavy type of pelvis. Although difficult to measure or even estimate in the living woman, I believe the superior strait to be normal or increased in area in this type.

These two types are as a rule readily distinguished upon examination, although some modifications of each will be met with and an occasional case which is hard to classify. A pelvis of the feminine type in which the measurements are very small constitutes a justominor pelvis. A pelvis of the muscular type in which the outlet contraction

is particularly marked is usually described as a funnel pelvis. These two are very naturally the most common forms of contracted pelvis in this country.

EFFECT OF TYPE OF PELVIS UPON THE COURSE OF LABOR

This study has been based upon three hundred consecutive primiparae attended in private practice, although confirmed by observations upon multiparae and patients at the Boston City Hospital obstetric ward. I have restricted my figures to primiparae for three reasons. First: because it is only in the first labor that the effect of type of pelvis can be accurately estimated. Second: to prevent the same patient appearing in the statistics more than once. Third: to exclude an undue proportion of cases referred because of difficulty in a previous labor. These primiparae were with few exceptions delivered in private hospitals around Boston between Jan. 1, 1918, and April 30, 1921. I have selected private cases only because I have been able to give them more detailed study than the hospital cases and in all instances to follow them through from beginning to end.

Proportion of Types.—The first or feminine type made up 221 cases or 73.6 per cent; and the second or muscular type 79, or 26.4 per cent.

Rupture of Membranes.—Rupture of the membranes before labor or at the onset of labor occurred in 18.3 per cent of the feminine type, and 38.4 per cent of the muscular type of pelvis. (Cesarean section was performed before onset of labor or rupture of membranes in eight patients of the first type and in one patient of the second type.)

Presentation and Position.—The accompanying table gives the number and percentage of the various presentations occurring in each type of pelvis.

PRESENTATION AND POSITION	FEMININE		MUSCULAR	
	NUMBER	PER CENT	NUMBER	PER CENT
O.L.A.	140	63.3	40	50.6
O.D.P.	50	22.6	25	31.6
O.D.A.	10	4.5	6	7.6
O.L.P.	9	4.0	5	6.3
Brow	1	0.4	1	1.2
Face	1	0.4	0	0
Breech	10	4.5	2	2.4

These figures show that in the muscular type of pelvis there is a decided increase in the proportion of the two posterior positions of the occiput, but a smaller number of abnormal presentations (brow, face, breech). This I attribute to the larger superior strait. To the same cause and the larger number of posterior positions of the occiput must be attributed the much larger percentage of premature rupture of the membranes, which is the most striking effect of the muscular type of pelvis upon labor. In the feminine type the head as a rule engages before labor and molds early. It also passes the plane of greatest resistance, which in this type is the superior strait, before the pains

have spent themselves and the patient become exhausted. In the muscular type the pelvis narrows toward the outlet and the resistance increases as the head descends. In the muscular type the perineum and the muscles and fasciae of the pelvis are stronger and offer greater resistance, and it is my belief that the cervix is more apt to be rigid.

Difficult Labors.—There were among the three hundred primiparae, three stillbirths due to difficult delivery, all in instances of the muscular type of pelvis, all associated with premature rupture of the membranes. In all of these patients because of the duration of the rupture of the membranes, cesarean section seemed contraindicated. Cesarean section was performed 33 times. In the feminine type of pelvis the measurements seemed sufficiently small to justify cesarean section as an elective operation in 11 patients. In six it was done after failure of the test of labor to bring the head into the pelvis. In six more it was done for nonpelvic reasons: placenta previa centralis, threatened eclampsia, multiple fibroids or elderly primiparity. Among the muscular type of pelvis the outlet was so small in three cases that elective cesarean section was performed. In seven more cesarean was performed after failure of the test of labor.

Reducing the above figures to percentages: in the feminine type elective cesarean section was performed for justominor pelvis in 4.9 per cent and after failure of the test of labor in 2.7 per cent, a total of 7.6 per cent for this type requiring cesarean section. As would be expected because of the greater difficulty in estimating disproportion in advance of labor in the muscular type of pelvis, elective cesarean section was performed in only 3.8 per cent but cesarean section after failure of the test of labor was done in 8.8 per cent bringing the total requiring abdominal delivery to 12.6 per cent, without counting the three stillbirths in which cesarean would have been performed had there been no contraindications. Therefore it will be seen that, excluding cesarean section performed for other than pelvic reasons, the muscular type of pelvis is considerably the more unfavorable of the two. This is still further borne out by the greater number of posterior positions of the occiput and the enormous percentage of premature rupture of the membranes.

Furthermore in the muscular pelvis, as has been stated, the resistance to the presenting part increases as the fetus descends, making interference more difficult, whereas in the feminine type the greatest difficulty is over once the head has passed through the superior strait, and low interference is relatively easy.

CONCLUSIONS

1. There are two distinct and easily recognizable types of normal female pelvis, which for purposes of designation may be called the "feminine" and the "muscular" types.

2. The first or "feminine type" presents external measurements closely approximating the 20, 25, 28 cm. of the textbooks with thin bones and a wide outlet.

3. The second or "muscular type" is characterized by large external measurements, but a narrow outlet and an angular pubic arch. The bones are as a rule heavier. The os pubis is thicker and more horizontal, and the pelvic inclination increased. The muscles and fasciae are firmer than in the first type.

4. Although both of these types must be considered as normal, the "feminine type" is much the more favorable for labor. In the "muscular type" premature rupture of the membranes occurs in nearly 40 per cent and posterior positions of the occiput are more common. In spite of the larger external measurements, cesarean section was necessary in a greater percentage of pelves of the muscular type. Both the normal mechanism of labor and operative interference are unfavorably affected by the horizontal os pubis and the greater pelvic inclination in this type.

REFERENCES

(1) Trans. Amer. Gynec. Soc., 1890, xv, 367. (2) Report Soc. Lying-in Hosp., N. Y., 1897, p. 258. (3) *Williams*: Obstetrics, 1920, p. 739. (4) Quoted by Quain: Anatomy, iv, pt. 1, p. 177. (5) *Quain*: Anatomy, iv, 1, pp. 176-178. (6) *Williams*: Obstetrics, 1920, p. 15. (7) Amer. Jour. Obst., 1915, lxxii, 121. (8) Amer. Jour. Obst., 1918, lxxviii, 528. (9) Amer. Jour. Obst., 1918, lxxvii, 714. (10) Edinburgh Med. Jour., 1917, xix, 82.

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EXOPHTHALMIC GOITER AND PREGNANCY

By Israel Bram, M.D., Philadelphia, Pa.

THE clinical implications arising from a combination of exophthalmic goiter or Graves' disease and pregnancy in the same individual are noteworthy. The problem is important and often difficult, for upon its solution depends the life both of the patient and offspring. During the past decade the author has seen a considerable number of subjects of Graves' disease in whom pregnancy was a factor and believes that the topic permits of the several subdivisions briefly discussed in this paper.

ENGAGEMENT AND GRAVES' DISEASE

The state of "engagement" is commonly replete with moments of emotionalism in which the sexual instinct plays an important part.

In all females with Graves' disease, the sexual instinct and emotions must be suspected as partially or wholly an etiologic factor until the contrary can be reasonably proved. In each patient a careful sexual history should be obtained and all possible sexual factors taken into proper account. The nature of the probable underlying predisposition should also be ascertained if possible.

The unengaged girl must be considered apart from the girl already engaged. Her sexual thoughts and possible habits must receive the necessary attention of the clinical attendant and should be tactfully corrected. This task is a delicate one, often difficult and at times apparently impossible. It may be inadvisable for such a person to become engaged until such time as the Graves' disease is sufficiently improved to render her relatively safe for marriage to a compatible mate. Such a union should be preceded by a minimal engagement period.

On the other hand, the already engaged girl with Graves' disease is often an individual in whom engaged life plays an important etiologic rôle. Since the continuation of the engagement is usually detrimental, it must be discontinued by an immediate estrangement or by immediate marriage. If the young man involved appears temperamentally and sexually compatible, it is prudent to advise immediate marriage, with admonitions regarding the practical side of the married state, in accordance with prevailing indications. Marriage is especially commendable if the patient's condition indicates the existence of an active recuperative power, and if her fiancé has the physical and mental virtues qualifying him not only as a devoted husband but also as a sensible assistant to the medical attendant. Under

such favorable conditions, marriage is usually followed by rapid improvement and ultimate recovery, often within a few months. This applies to the average, especially the early subject of the disease; but there are glaring exceptions to the above. In a patient whose vital

Fig. 1.—Exophthalmic goiter of one year's duration in a nonpregnant patient married thirteen months.

Fig. 2.—Exophthalmic goiter, the onset of which occurred three years ago following a narrow escape during an accident. Patient is married one year and is in the fifth month of pregnancy.

organs are too far degenerated to withstand a prospective pregnancy, it is preferable to face the danger of a broken engagement rather than the peril of marriage.

Fig. 3.—Exophthalmic goiter of six months' duration in a patient married one year. Syndrome appeared shortly after a miscarriage and curettement. Weight of patient 107 pounds; beginning exophthalmos and swelling of thyroid gland; heart rate 140; moderate gastrointestinal irritability and psychic disturbance.

Fig. 4.—Same patient as in Fig. 3, after six months' nonsurgical treatment. Weight, 143 pounds; complete subjective and objective recovery.

FECUNDITY IN A SUBJECT OF GRAVES' DISEASE

In both sexes, in the presence of Graves' disease sterility is common, but not the rule. In the male who had not been sterile prior to the onset of the syndrome, I have observed an increased fecundity. Indeed, the sexual activity of the patient is at times increased to such a degree that it constitutes an important problem in treatment. Priapism may require especial therapeutic attention. The patient's moral sense may become all but eliminated, and gratification may be sought away from his own household. Sexual excitability increases the endocrine dysfunction, especially that of the thyroid; the latter seems in turn to increase the sexual excitability,—thus there is added another vicious circle to those already characterizing this affection.

In the female suffering with Graves' disease, though the libido may be normal or acute, there frequently occurs a degree of vaginismus and a dread of coitus. Often this status bears an etiologic relationship to Graves' disease. Here, also, the vicious circle obtains: ungratified desire leads to an aggravation of the syndrome of Graves' disease; the aggravated syndrome in turn leads to increased libido. In consequence of diminished frequency of coitus and because of the probable coexisting menstrual disturbances and ovarian hypofunction in these patients, there may be sterility in some instances and lessened fecundity in others, especially during the active stage of the disease. Many patients become pregnant, however, and when this occurs, other problems present themselves.

PREGNANCY AND GRAVES' DISEASE

Here, too, in an important percentage of cases pregnancy seems to have been the exciting cause of the affection. Omitting this phase of the question, I would state in general that pregnancy helps rather than hinders improvement where Graves' disease already exists. Especially is this true if the disease has not led to marked degeneration of the vital organs, and if the patient is under the care of a well equipped internist who understands the management of these subjects. A moderate aggravation of the syndrome, especially the thyroid swelling, may occur in pregnancy, to disappear shortly after delivery. On the other hand, the occurrence of pregnancy in a markedly advanced case of the disease is usually detrimental, as the vital organs are unable to cope with the increased demands made upon them. Sooner or later Nature either expels the uterine contents, or, if this does not occur, the physical condition may require a therapeutic abortion.

MISCARRIAGE IN GRAVES' DISEASE

It has been taught in some quarters that in this disease not only is sterility the rule, but that when pregnancy occurs, miscarriage is apt to result within the first few months. In my experience, sterility and

miscarriage occur in the minority of these women. All things equal, the patient who miscarries is worse off than she who is delivered at term. The reasons are (1) *mental*, i.e., on the one hand, the unhappiness re-

Figs. 5 and 6.—Five years ago, this patient applied for treatment of a very severe type of exophthalmic goiter of four years' duration, the onset of which occurred shortly after engagement to be married. After six months of nonsurgical treatment, patient was so improved as to render marriage safe. In the above pictures taken shortly after marriage, though all other symptoms have been eliminated, there is a still prevailing thyroid swelling and some exophthalmos, due to anatomic changes incident to the chronicity of the affection.

sulting from the loss of the fetus, especially if this be the first pregnancy, and on the other, the happiness and contentment of motherhood; and (2) *physical*, i.e., the disturbance of the endocrines, especially the

Fig. 7.—Same patient with normal child. There was a postpartum hemorrhage for which the obstetrician was prepared, and patient made an uneventful recovery. She feels better than ever in her life. There is a peculiar redundancy of skin over site of former thyroid swelling.

sexual organs and the thyroid during abortion, and the tendency toward adjustment or rectification of the internal secretions and the nervous system following normal delivery at term. I find that sub-

jects of Graves' disease who have recently miscarried are comparatively more difficult to manage than those patients who have recently become mothers. The latter respond promptly to the treatment of the individualizing internist, if favorable personal and environmental cooperation prevails.

PARTURITION IN GRAVES' DISEASE

Parturition in a subject of Graves' disease is fraught with at least two problems. The first is that of straining with each pain. Bearing down not only adds to the undue strain of an overworked heart, but also increases the size and vascularity of the thyroid gland. In addition, the accompanying pain is a kind of shock which had preferably be avoided. I advise the obstetrician to employ his art in such manner as would obviate the necessity for bearing down, and suggest the use of a few whiffs of chloroform and whatever other measures may be deemed advisable at the time. The second problem is that of postpartum hemorrhage. The coagulation time of the blood in a subject of Graves' disease is delayed, in some instances to such an extent that the patient should be managed with the same degree of caution as is directed toward a subject of hemophilia. I suggest the use of prophylactic injections of "thromboplastin" or similar preparations during labor. It is essential also to be in readiness for packing the uterus after delivery of the placenta. Postpartum injections of pituitrin are harmless and frequently useful in this connection.

EFFECT OF THE MOTHER'S GRAVES' DISEASE ON THE INFANT

Theoretically, a child born of a mother with Graves' disease would be either predisposed to or afflicted with an endocrinopathy. In view of the fact that the average subject of Graves' disease presents a history in one or more members of the family of this disease, Raynaud's disease, angioneurotic edema, hay fever, bronchial asthma, hysteria, neurasthenia, and other affections involving the neuroendocrine system, it would seem that the offspring of such patients would be prone to these affections. However, my observation of a goodly number of these youngsters, some of whom are attending school, proves them to be enjoying the average good health, and a few are exceptionally robust. What puberty and adolescence have in store for them is to be seen; attempts at prophylaxis in these persons should be seriously considered.

There is one peculiar phenomenon which is noteworthy in this relation. Occasionally, *an infant born of a mother suffering with this affection may present congenital goiter with or without evidences of hypothyroidism or of cretinism.* Several observers have called attention to this occurrence, and I have seen three instances of this sort in the past few years. This should give the surgeon much food for thought, as it

presents one of the most striking arguments against thyroidectomy in this affection. It seems strongly to indicate that the body requires all the thyroid substance which the thyroid gland can manufacture in order that toxins originating elsewhere in the body may be combated, and that the thyroid swelling in Graves' disease is a defensive reaction on the part of Nature in its efforts toward recovery.

EFFECT OF LACTATION ON THE COURSE OF GRAVES' DISEASE

Lactation is decidedly harmful to a subject of Graves' disease. The patient is already suffering with a high plus basal metabolism and further to drain the body of nutriment by lactation makes for greater loss in weight and aggravation of the disease. Lactation must be discouraged after the first week or two, and the baby should be fed by a wet nurse or placed on an artificial mixture as soon as possible. I have often seen a very miserable patient improve with surprising

Fig. 8.—Exophthalmic goiter with unilattral exophthalmos; onset during pregnancy. Patient was nursing her six weeks' old baby when treatment was instituted. Heart rate 120.

Fig. 9.—Same patient as Fig. 8 two months later, following cessation of lactation and institution of nonsurgical therapeutic measures. Eyes nearly normal, thyroid smaller, pulse is normal, and there is a gain of 20 pounds in weight. Patient is still under treatment and is rapidly approaching complete recovery.

rapidity very soon after breast feeding was discontinued. Moreover, the infant in taking the milk of such a mother, is receiving food contaminated with the toxins of Graves' disease. It is evident then, that such infants do far better away from the mother's breast.

REPEATED PREGNANCIES IN SUBJECTS OF GRAVES' DISEASE

Sufferers from Graves' disease as a rule do not become multiparae during the course of the affection, for reasons already implied above. When repeated pregnancies do occur, there is a tendency on the part of the thyroid toward hyposecretion. Such patients are especially prone to present a combination of hypo- and hyperthyroidism simultaneously,

with a predominance of the former. Also, among such patients an occasional "burned out" thyroid is observed, in which the patient, evidently tending toward spontaneous recovery, is seen to overlap this point and soon takes on the clinical picture of a varying degree of myxedema. It is well for both endocrinologist and obstetrician to advise against repeated pregnancies in these patients. With regard to contraceptives, it must be borne in mind that considerable thought should be given the matter before final advice is offered the patient, lest great harm result from improper measures. This is a vital matter, and if carefully studied in advance will be of assistance in the ultimate restoration of our patient to health and happiness.

In conclusion, we must emphasize the fact that since no two cases of Graves' disease are alike, there is no standard management applicable to all patients of the type indicated in this discourse. Individualization must guide our course. The hereditary trends of the patient, her age, temperament, social stratum, financial resources, peculiarities and idiosyncrasies, the probable pathogenesis of the affection as well as its duration and severity,—all these must be taken into serious account and properly evaluated when the problem of pregnancy with its antecedents and sequences becomes a factor during the course of Graves' disease.

1431 SPRUCE STREET.

OBSERVATIONS ON THE DISTRIBUTION AND FUNCTION OF THE UTERINE CILIATED EPITHELIUM IN THE PIG, WITH REFERENCE TO CERTAIN CLINICAL HYPOTHESES

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THE ciliated epithelium along the path of the ovum has long been a subject of interest as a possible factor in determining the movements and ultimate resting place of the ovum, and also because it has been believed to take part in the periodic changes of this pathway, such as those occurring during menstruation and estrus. The evidence has rested upon observations on the human and practically all the laboratory animals.

According to Mandl (1911) and Hoehne (1908), in the human uterus the cilia diminish in number before menstruation, vanish entirely during that period, and gradually reappear afterwards. In material from the human, examined *in vivo*, Mandl found no cilia during menstruation or on the second, third, and fourth days thereafter. He saw cilia

again on the seventh day after menstruation and from 1 to 8 days preceding the next flow. Other evidence in agreement with this supposed absence of cilia during menstruation has been offered by F. Christ (1892), Bayer (1906), and Hitschmann and Adler (1908), while on the contrary Wendeler (1895), Moericke (1882), and Geist (1913) record finding cilia during menstruation.

Hitschmann and Adler (1908) in examining fixed material found cilia only sparsely or not at all in the uterine mucosa, though in the late interval and pre-menstrual periods frayed-out surfaces on some of the epithelial cells were described as resembling epithelium from which cilia had broken away. At the same time these cells had the appearance of secretory epithelium (Drüsenzellen). It is further stated that "in the pre-menstrual period, during which the ovum probably reaches the uterus, the cilia disappear at the onset or perhaps coincidently with the secretion. Thus it would appear that the further transport of the ovum is impeded and implantation favored."

Other evidence of secretory activity coincident with the loss of cilia rests (according to Mandl) upon Schaffer's observations in animals. In sections of the isthmus at times the latter found only glandular epithelium, at other times ciliated cells, and hence inferred the transformation of the latter into the former. In the human, Hoehne states that in pregnancy, disappearance of cilia from the cervix becomes evident, especially as the cervical canal becomes filled with secretory masses. And finally Mandl (1911), pointing out that during menstruation (at which time he found no cilia) a serous secretion is mingled with the hemorrhagic discharge, concludes that in the uterus secretory epithelium periodically develops where before it was ciliated, and vice versa.

With such possible variations in the activity of the ciliated epithelium in mind, explanation of various pathologic conditions has been attempted by several authors. In placenta previa, the abnormal site of implantation has been regarded by Hoehne (1911) as the result of an abnormal extensive ciliation which increases the strength of the ciliary current so as to sweep the ovum farther along toward the cervix than normally. That the influence of cilia in the transportation of the ovum may be a factor also, even before fertilization, was suggested by R. Jolly (1911), who stated that the closer to the uterine end of the tube the fertilization occurs, the farther along toward the cervix will the fertilized ovum be carried before it becomes developed sufficiently to be capable of implantation. Likewise, sterility may result from abnormal ciliation, as the ovum finds no resting place for implantation (Hoehne, 1911). In some recent observations regarding tubal pregnancy this author (1917) concludes that insufficiency of ciliation, either through inflammatory or developmental disturbances, is a factor

among the mechanical obstructions by which he would account for implantation at an abnormal site.

In chronic hyperplastic conditions of the uterine mucosa, Hoehne (1911) has found that "the extent of the ciliated epithelium and the strength of the current is increased in proportion to the hyperplasia * * * and that cilia are present even during menstruation." Such observations included cases of profuse and long continued menses, myoma uteri, excessive bleeding after absorption, and pre-climacteric menorrhagia.

Among the lower animals, particularly swine, the presence of cilia in the uterus has been both affirmed and denied by various authors. Lott (1872), Storch (1892), Ellenberger and Gunther (1908), found cilia present, while Schmalz (1911), Keller (1909), and Beiling (1906) deny the presence of cilia on the surface epithelium, and Beiling doubts their occurrence even in the uterine glands. Mandl (1911) holds that there is a transitory ciliation. Having observed 39 animals, including 24 dogs, he states that the animal uterus is covered by a secretory cylindrical epithelium, which at times, though indeed but briefly, changes into a ciliated epithelium. It may be noted that this brief phase of ciliation in the lower animals stands in sharp contrast to the longer phase described by him in the human, since he believes that the mature human uterus is covered by ciliated epithelium during the greater part of its cycle and that the period when cilia are absent coincides with menstruation.

During estrus, both a diminution and an increase in cilia have been described, dependent upon the site. Stegu (1912) saw fewer cilia on the surface epithelium in the sow's uterus during heat, and just before and just after it, than at other times in the cycle. An increase in ciliation between the ovary and the ostium of the tube at the time of estrus, as a result of transformation of the squamous epithelium of the peritoneum to a ciliated cylindrical type, has been described by Morau (1892) in the sow, dog, cat and mouse.

PERSONAL OBSERVATIONS

In evaluating the data and hypotheses which have been reviewed, it may be pointed out that they have not always been based upon the fullest possible knowledge of the normal uterine cycles of the animals studied, or upon the full range of available technical methods. A satisfactory idea of the functions and possible pathologic relations of the uterine cilia must take into consideration the periodic alternations of structure and function in the reproductive tract; especially must the state of the cilia be correlated with the time of passage of the ovum. This of course is not yet possible in the human species, in which, moreover, many of the observations as to the presence of cilia have extended no further than sections of fixed material. Among the lower

animals, while observation has been practically as extensive as the number of domesticated species permits, in no case has investigation of any one species been complete.

The following pages outline an attempt to carry out a complete study of the uterine ciliation in one species, throughout the cycle. For this purpose the domestic sow was chosen, on account of the abundance of material available, and also because of the fact that recent work on the reproductive cycle of this species makes it possible to select from the uteri obtained at the abattoir a series which shall be representative of all stages of the cycle, and to study these in the light of accurate knowledge of the time of ovulation and the wandering of the ova and embryos in this species.

The choice of material representative of the successive stages in the 21-day cycle of the sow was made, upon the basis of previous acquaintance with the events of the cycle, by inspection of the ovaries and by search of the fallopian tubes and uteri for ova, and was confirmed by microscopic study of sections of the corpora lutea and the uterine mucosa. The necessary data have been given in a monograph by one of the present authors (Corner, 1921 a) and need only brief mention here.

Thus, during the three days following ovulation there are freshly ruptured follicles (i.e., early corpora lutea) in the ovaries, and the ova may be recovered from the fallopian tubes. About the fourth day the ova pass into the uterus, whence they may be recovered by washing out the uterine canal. By the seventh day the corpora lutea are solid, and have reached a diameter of 9 mm. The microscopic picture is now that of full maturity. About the seventh or eighth day the ova disappear by degeneration within the uterine cavity, and thus the second week is characterized by the presence of fully matured corpora lutea in conjunction with the absence of ova from the tube and uterus. About the end of the second week the corpora lutea suddenly degenerate, as indicated by a beginning diminution in their size, by an increase in the firmness of their texture, and by a change of color from the flesh color of maturity to a yellowish tone. The microscope reveals degeneration of the granulosa lutein cells. During the latter part of the third week the new crop of Graafian follicles begins to exceed the resting stage of 4 to 5 mm. diameter, until finally they reach the mature diameter of 8 to 10 mm. Their rupture at the end of the third week marks the beginning of a new cycle. Figure 1 presents a graphic representation of the reproductive cycle as just described.

By the aid of these criteria, and by comparison with the characteristic cyclic histologic changes of the uterine mucosa, as illustrated in the above-mentioned monograph, it is possible to assign a given specimen of the internal genitalia of a sow to its correct place in the cycle,

within a few days, and thus to collect any desired series of stages directly from abattoir material. The following list enumerates the specimens upon which our present observations are based:

First to 3rd day of pregnancy cycle, 4 specimens; 4th to 7th day, 5; 8th to 10th day, 4; 10th to 15th day, 3; 15th to 20th day, 2. Blastocysts in uterus, 1; embryos of 17-18 days, 2.

As soon as the specimens arrived at the laboratory, usually within an hour after killing, bits of the mucosa were snipped off and flattened down under a cover-slip, as Nylander had done in Leydig's laboratory in 1852 when he first discovered active cilia in the uterus of the pig. In such preparations from the tubes and uterus, cilia were always seen actively beating even under low powers of the microscope. Neither a

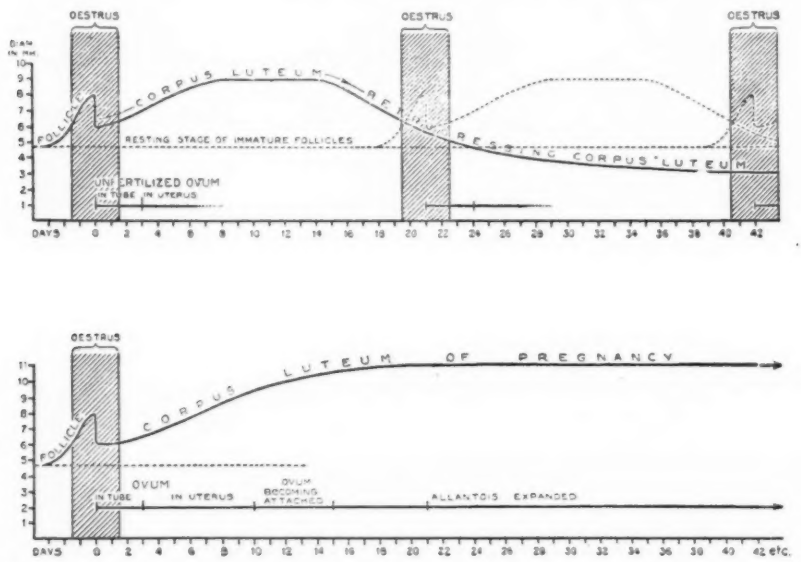

Fig. 1.—Diagram showing in graphic form the relations between estrus, ovulation, the development of the corpus luteum, and the progress of the ova in the sow.*

Above: events of the average cycle of 21 days in the nonpregnant sow.

Below: events of the first weeks of pregnancy.

warm chamber nor nutrient media were found necessary, for at ordinary room temperature, even without the addition of Locke's solution, the active cilia could be observed for several hours at least. This was true throughout all phases of the cycle as well as during pregnancy. In the specimens from the uterus, however, cilia were never seen on the surface, but only in glands opening upon it, where the ciliated cells comprise perhaps one-fourth of all the epithelium. Significant variations in number and activity of the cilia were never observed.

In the sections of fixed material from the same uteri which were

*This and the following illustrations are taken from an article by G. W. Corner on "Cyclic Changes in the Ovaries and Uterus of the Sow, and Their Relation to the Mechanism of Implantation." (Carnegie Institute of Washington, Publ. No. 276.)

examined in the fresh condition, cilia were always found readily in the glands (Figure 2). In addition, the confusion of Beiling (1906), Stegu (1912) and others as to the irregular or frayed-out surfaces of many of the cells of the superficial epithelium, suggesting loss of cilia or even secretory activity, became more intelligible. The accompanying

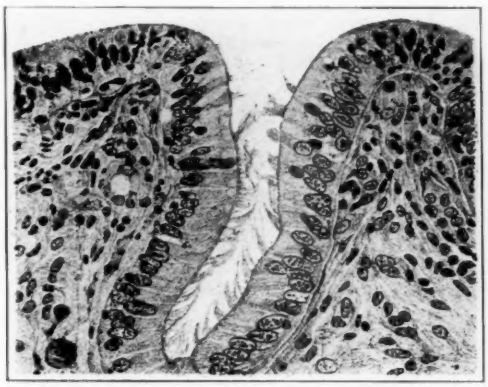

Fig. 2.—Neck of a uterine gland showing presence of cilia on the gland-cells and their absence from the surface cells, x300.

Figures (3, 4, and 5), taken from the paper of Corner (1921 a) demonstrate that during the phase of estrus (Figure 3) and the postestrus development of the uterine mucosa (Figure 4) the surface epithelial cells present smooth borders. During the stage of the 10th to the 15th

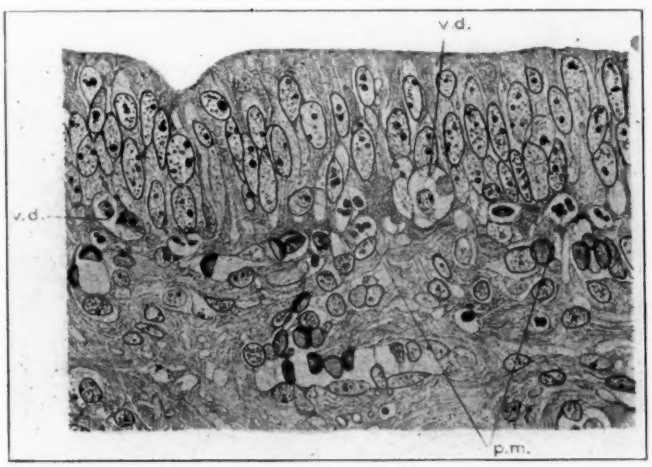

Fig. 3.—The uterine epithelium during estrus, x600.

day after ovulation, however, (at which time the embryos, if present, are becoming attached) the epithelial cells undergo a remarkable alteration of surface by the production of cytoplasmic processes, as illustrated (Figure 5). These processes occur, of course, on the same cells which a few days before have given appearances of a secretory func-

tion (Figure 4); they have nothing in common with ciliation, as evidenced above all by the absence of basal granules. We suppose that this surface roughening serves to facilitate attachment of the embryos. Similar processes can be observed in the living tissue in somewhat less detail; and they have also been clearly described in the human uterus and differentiated from the cilia by Geist (1913). There seems to be

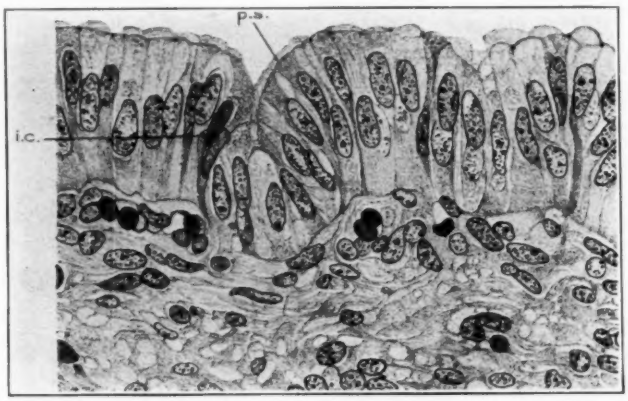

Fig. 4.—The uterine epithelium during the stage of 8 to 10 days after ovulation, x600.

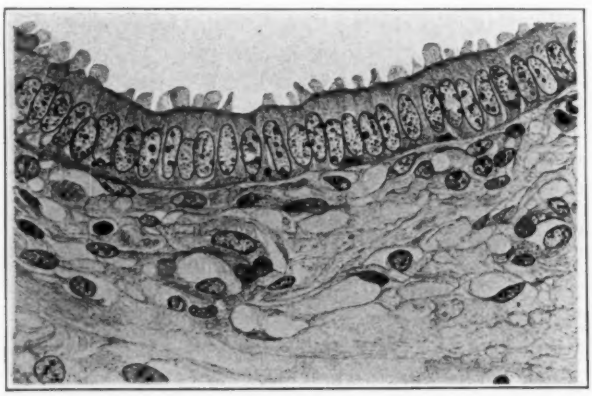

Fig. 5.—The uterine epithelium during the stage of 10 to 15 days after ovulation, x600.

no doubt that such appearances as these have helped to bring about the confusing disagreement as to the uterine cilia.

DISCUSSION

From the foregoing observations on the uterus of the pig it may be concluded that no cilia are present, at any period of the estrous cycle, on the cells of the surface epithelium. In the glands of the uterine mucosa, however, the cilia are always present and appear to be equally active and numerous at all periods of the cycle. Previous statements disagreeing with these conclusions are probably explainable, as we

have seen, by the occurrence of histologic changes in the superficial epithelial cells, somewhat resembling ciliation.

In the uterus of the pig at least, the cilia thus seem less important for transport of the ova than has frequently been supposed in regard to many animals, as for instance in man where (as expressed by Grosser) "the chief driving power in the wandering of the ovum, in the uterus as well as in the tube, is the ciliary current." With regard to the uterus, we are led to the same viewpoint which Sobotta (1916) has taken as to the forces which carry the ova through the fallopian tube of the rodents.

The occurrence of cilia at all times throughout the cycle and not only during the few days in which ova are present, suggests that the ciliation of the uterus is adapted to other functions beside the transport of the ovum. In fact, as shown by the studies of Corner (1921 b) on internal migration of the ovum, when there is an excess number of unimplanted embryos in one cornu of the sow's uterus, some of the embryos usually pass into the opposite cornu, frequently traversing a considerable distance down one cornu and up the other before reaching the site of implantation. Thus, whatever be the direction of any currents produced by the uterine cilia, early embryos can certainly be transported against them. The presence of the cilia through all stages of the cycle hints at the possibility that among their functions is that of producing a current to carry away cellular debris or perhaps secretory products of the mucosa, or to guard against the upward passage of infectious microörganisms.

This evidence from the pig's uterus, therefore, indicates that it is at present unsafe to erect etiological hypotheses upon supposed cyclic alternations in number, activity or secretory state of the uterine ciliated epithelial cells, or even to regard them as of prime and sole importance for the transportation of ova into the uterine cavity.

SUMMARY

1. In the pig's uterus, cilia are not present on the surface epithelium at any stage of the estrous cycle; but in the uterine glands they are always present, without obvious fluctuation in number or activity.

2. There is no evidence for an alternation of ciliated and secretory (nonciliated) phases in individual cells of the uterine epithelium of the sow.

3. Upon the basis of this and other facts which have been cited it would seem that transportation of the ova and embryos is not necessarily the prime function of the uterine cilia.

4. It is suggested that various hypotheses explaining pathologic states of menstruation and of implantation by supposed variations of the uterine cilia are not sufficiently supported by complete knowledge of the cyclic changes of the uterine mucosa.

REFERENCES

Bayer, H.: 1906. Die Menstruation in ihrer Beziehung zur Conceptionsfähigkeit. Strassburg. *Beiling, K.:* 1906. Arch. f. mikr. Anatomie, lxvii, 573-637. *Christ, F.:* 1892. Das Verhalten der Uterusschleimhaut während Menstruation. Inaug. Diss. Giessen. *Corner, G. W.:* 1921, a. Publications of the Carnegie Institution of Washington, No. 276 (Contributions to Embryology, No. 64) pp. 117-146. Ibid.: 1921, b. Johns Hopkins Hosp. Bull., xxxii, 78-83. *Ellenberger, W., and Gunther, G.:* Grundriss der vergleichenden Histologie der Haussäugetiere, 1908. *Geist, S. H.:* 1913. Arch, f. mikr. Anatomie, lxxxi, 196-219. *Grosser, O.:* 1919. Arch. f. Gynäk., cx, 297-327. *Hitschmann, F., and Adler, L.:* 1908. Monatschr. f. Geburtsh. u. Gynäk., xxvii, 1-82. *Hoehne, O.:* 1908. Zentralbl. f. Gynäk., xxxii, 119-125. Ibid.: 1911. Zentralbl. f. Gynäk. xxxv, 340-343. Ibid.: 1917. Arch. f. Gynäk., cvii, 73-104. *Jolly, R.:* 1911. Arch. f. Gynäk., xciii, 69-86. *Keller, K.:* 1909. Anat. Hefte., xxxix, 309-391. *Leydig, F.:* 1852. Arch. f. Anat. u. Physiol., 375-378. *Lott, G.:* 1872. Zur Anatomie und Physiologie des Cervix Uteri. Erlangen. *Mandl, L.:* 1908. Ueber das Epithel im geschlechtsreifen Uterus. Zentralbl. f. Gynäk., xxxii, 425-429. Ibid.: 1911. Monatschr. f. Geburtsh. u. Gynäk., xxxiv, 150-159. *Möricke, R.:* 1882. Ztschr. f. Geburtsh. u. Gynäk., vii, 84-137. *Morau, H.:* 1892. Nouvelles Archives d'Obstetrique et de Gynec., 7, 422-427. *Schaffer, J.:* 1908. Monatschr. f. Geburtsh. u. Gynäk., xxviii, 526-542, 666-688. *Schmaltz, R.:* 1911. Die Struktur der Geschlechtsorgane des Haussäugetiere, Berlin. *Sobotta, J.:* 1916. Anat. Hefte., xliv, 361-444. *Stegu, J.:* 1912. Oesterreichische Wochenschr. f. Tierheilk., xxxvii, 399-400, 409-411, 419-421, 431-433, 442-443. *Storch:* 1892. Oesterr. Wchnschr. f. Tierh. (quoted by Mandl, 1911.) *Wendeler, P.:* 1895. Ztschr. f. Geburtsh. u. Gynäk., xxxii, 316-319.

THE RELATIONSHIP BETWEEN TOXEMIA OF PREGNANCY AND UTERINE SEPSIS FROM A STUDY OF 400 TOXEMIC CASES

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WHEN this paper was originally read before the Obstetrical Society of Boston, February 24, 1920, I prefaced it with certain observations regarding toxemia of pregnancy and uterine sepsis calculated to show my audience the temper in which I had approached the study of the subject. These observations were in effect that toxemia of pregnancy and uterine sepsis were the two most interesting and baffling problems in obstetrics today. I stated that we know little or nothing new about toxemia of pregnancy of clinical value; that we have run a circle for many years in its treatment, favoring methods of elimination; that in toxemia with convulsions we have no ground for a prognosis even; that in spite of the best of watching toxemia does occur; that in the majority of cases that die we do not know the exact cause of death. I recalled two cases recently observed, one a woman with eight or nine convulsions on whom I did a difficult vaginal cesarean section. She was in coma before and for some time after delivery, and made a good recovery. The other, the next day, was also in coma, having had one convulsion and a normal delivery, and died two hours

after I had given a fair prognosis. I said that in no respect did these women differ so far as medical clinical observation went, yet one died and the other recovered. Even supposing at autopsy there was a difference, we cannot make our autopsy before the patient dies, and clinically we are at a loss for an intelligent prognosis.

I said that toxemia with convulsions occurs once in each seventy admissions at the Boston Lying-in Hospital, and that the mortality there for the last seven and one-half years was twenty-five per cent. I then read this quotation from a report of a physician in Texas who, after treating three cases of toxemia with chloroform and some alleged kidney stimulant, concludes that: "while toxemia may occur very rarely in cases who are having urine examinations, death never need occur if the case is properly treated," *vide supra.*

I then said that uterine sepsis was interesting also because we knew so little about it; especially that we knew nothing more of hospital sepsis in obstetrics, and its manner of spreading, than was known at the time of Holmes and Semmelweiss; in fact by many hospitals doing maternity work sepsis was held not to exist at all in modern times. I quoted from the report of another physician from Texas who reached the conclusion, after I know not how much experience, that uterine sepsis is always due to the operator or his assistants at the time of delivery, and that all uterine sepsis is therefore unnecessary. I said also that uterine sepsis is morbidly interesting to me because it had been the subject of so many fantastic lies in my experience. I then observed that whereas the matter of whether an individual physician called a given case, running a temperature a few days after childbirth, milk fever, or constipation, or blood poisoning, or uterine sepsis was a matter of individual conscience, and in a way, perhaps, salesmanship, and was for each man to justify for himself; but that, when we found a high percentage of temperatures running in a maternity hospital, or in the maternity part of a general hospital, we and the public then have the right to expect that this epidemic should be designated hospital sepsis. In the light of our present lack of knowledge regarding the spread of this, or often of the initial focus of infection, we have the right to expect that this or that given hospital shall shut its doors to further obstetrical patients until with lack of material, and cleanliness in all its forms, the epidemic shall have run its course. The reason is that it is safer, if less comfortable, to have a baby in the gutter than in an infected hospital.

I said further that I had seen in some detail five such epidemics of variable extent, in eight years, and in only one was the institution closed, and in that one alone were no lives lost. I said that the reason that this was not done in the others was either through ignorance on the part of lay boards of trustees or doctors (usually surgeons) in

charge, or fear by them of admitting that hospital sepsis still existed in the community, or an unwillingness to accept financial loss due to closure. I said that the reason boards and doctors in charge were afraid to shut up was not only that "the public is not sufficiently educated in clean obstetrics," as is so often said and is true, but also that *the public is uneducated regarding uterine sepsis.* While much sepsis is due to dirty obstetrics, much also is due to other things. Evidence is accumulating all the time that autoinfection, especially in cases of difficult delivery, due to unavoidable causes, is a cause; for bacteriologic investigation has shown that the vagina in a certain percentage of pregnant women contains pathogenic organisms. Evidence also accumulates that a certain number of infections are respiratory in origin, or tonsillar; occasionally a uterine sepsis seems traceable to a tooth as much as some pyelitis cases. The accumulation of evidence regarding the mutability of strain of streptococci, etc., all tend to confirm the fact that a certain variable percentage of uterine sepsis is due to other causes than dirty obstetrics.

It is frequently said, and I think generally considered, that a patient with toxemia of pregnancy is more susceptible to infection than a patient normally pregnant. I have said, and heard other obstetricians say, that such and such a patient is septic because she was toxemic, meaning that the toxemia had reduced her resistance to infection so that she became septic when she otherwise would not have done so; or that she was not handling the sepsis well and was severely sick with it on account of her toxemia, when if she had not been toxic she would presumably have had only a mild sepsis. We mean that the toxemia is a large contributing factor in the sepsis.

Williams, *Obstetrics,* Second Edition, page 554, says: "In view of the marked liability of eclamptic women to infection, all operative measures must be conducted in the most rigidly aseptic manner, particular care being taken to avoid the contamination of the vagina and the hands of the operator by fecal material."

A further study of the text book literature in regard to this matter reveals that there is nothing on the subject in the *Year Books of Obstetrics* from 1916 to 1919; nothing in Reynolds and Newell's *Practical Obstetrics,* and nothing in *The Practice of Obstetrics* by Cragin. In the English Berkeley and Bonney, Second Edition, under "Sequelae of Eclampsis" is stated: "Patients who have had eclampsia are liable to the further complications of puerperal insanity, *puerperal fever* on account of operative manipulations, etc.," and later, speaking of operative evacuation of the uterus in eclampsia: "In our opinion the abdominal route is best as being quicker, easier, and more *aseptic.*" (italics mine.)

De Lee, First Edition, 1913, page 355, after describing the series of

convulsions of the typical eclamptic as accompanied or followed by fever, says: "A recrudescence of the fever usually means that sepsis is starting." On the other hand, "If the woman is going to die, the attacks usually increase in frequency and force; the temperature goes up to 103°, sometimes to 107°, or it sinks; the pulse increases, becoming weak and running." As a rule the case ends one way or another in three days. On page 361, "Infection is a common cause of death and eclamptics (he uses the term here for toxemics without as well as with convulsions if they have all the symptoms without the fits) show a decided susceptibility to it. Sepsis is common and usually runs a severe course since the liver and kidneys are already diseased." Speaking of abdominal cesarean section in eclampsia he says: "Sepsis is much more common." Again, "During the delivery of eclamptics extraordinary precautions against sepsis must be observed because they are particularly liable to infection, the liver and kidneys being thrown out of immunizing action. In spite of the most rigid precautions the author has seen fatal infection arise. One source of trouble is feces streaming from the anus, the result of the administration of cathartics and enemata before delivery. This danger is so great that the author withholds such practice until after the uterus is emptied. If the field of operation is constantly soiled by discharges from the rectum, the anus should be closed by a circular suture, *which is to be removed just before the child is delivered.*"

It will thus be seen that textbooks, where they have anything to say on the subject, back up our stated belief either directly or by implication, that toxemia of pregnancy is a contributing cause of puerperal sepsis.

My own experience has borne this out, both in my personal and consultation practice. More dissatisfied with this single feature of my work than any other, I chose two hundred consecutive cases of my own, in which the records were good, to see what the relationship was between toxemia of pregnancy and uterine sepsis.

Briefly analyzed the results were as follows: In 167 there was no sepsis and no toxemia except of a mild sort which readily yielded to medical treatment. There were present slight traces of albumin or elevated blood pressure which was either moderate in amount, or yielded quickly. There were fifteen cases of sepsis in nontoxic patients (it is to be remembered that these cases include consultation and delivery by other men as well as by myself). There were nine cases of toxemia unaccompanied by sepsis. There were nine cases of sepsis and toxemia. By percentage: 83.5 per cent were free from both sepsis and toxemia; 16.5 per cent were either toxic or showed sepsis; about 7 per cent showed sepsis unaccompanied by toxemia; and about 8 per cent were toxic, 50 per cent of which were septic. It will be

seen by these figures that whereas the rate of sepsis in all cases not toxic was one in eleven, the rate of sepsis in toxic cases was one in two. Of the twenty-four septic cases, 38 per cent were toxic.

It would have been more desirable in this accumulation of data to have used only cases in my own practice where the percentage of normal sepsis would, of course, have been much lower than the cases of other men calling me in consultation, because I only saw from their practice cases which had gone wrong. This is somewhat balanced, however, by the fact that as a rule I saw the severe toxemias, at least, in the practice of the same men, and sufficient data was available only in this way. Having established the fact that the ratio of uterine sepsis in severe toxemias that I had seen was one in every two cases, as against one in every eleven cases that were not toxic, (irrespective of method of delivery) I determined to go through as many records of toxemias of pregnancy as possible, and by using a large control of nontoxemic records, establish the relative percentage of sepsis in toxemics and nontoxemics. Furthermore, I determined to attempt to settle finally whether toxemia of pregnancy does lower resistance to sepsis, and to what extent; and by comparison to demonstrate whether or not my results were worse than they should be. The purpose of a large series is to obtain both in the toxemic series and the nontoxemic control series, including enough cases delivered in the same manner so that we can throw out the method of delivery by checking one against the other, and have our comparison direct.

The series studied from the Lying-in Hospital records of 7,326 cases of admission are from April 20, 1912, to January 21, 1920—seven years and nine months. The reason for stopping abruptly at this time was that a severe epidemic of hospital sepsis ended on the earlier date, and it was felt that it was better to avoid these records in which there would be an undue amount of sepsis irrespective of toxemia.

During the period there were 7,326 admissions, which included 400 toxemias with or without convulsions; 103 with convulsions; 297 without convulsions. There was one toxemia with or without convulsions in each eighteen admissions, about 5 per cent. There was one toxemic with convulsions in every 71 admissions, or about 1.5 per cent. Toxemia without convulsions represents one case in every twenty-five hospital admissions, 4 per cent. Of the 103 with convulsions 27 died, a mortality of about 25 per cent. Of the 27 cases with convulsions that died, 23 cases died within thirty-six hours of entrance. Of these 23 cases, 20 died without further diagnosis than of "eclampsia." The other three complications were separated placenta, postpartum hemorrhage, antepartum pneumonia. Of the cases that died more than thirty-six hours after delivery, three in number, one died of terminal bronchopneumonia plus the toxemia, on the fifth day; and two of def-

inite sepsis,—one a streptococcus septicemia, on the ninth day, and one a pulmonary embolism following uterine sepsis, on the fifteenth day. In the series of fatal toxemias with convulsions 9 per cent died of uterine sepsis; 83 per cent died of eclampsia without further diagnosis and within thirty-six hours of entrance. Of the series of 103 toxemias with convulsions, 27 died, reducing the number to 76, from which it is possible to study the question of sepsis. In one of these seventy-six the diagnosis is not certain and is therefore omitted.

The question of what constitutes sepsis is one capable of different interpretation, but for the purposes of this paper we have divided all cases in this respect into three groups: one called the Normal Temperature Group, in which the temperature never rose above 99° during the puerperium; two, the Group of Slight Elevation in which, though the temperature is elevated for one or more days, there is no evidence either in the lochia, the involution and feel of the uterus or lower quadrants, and no evidence on the discharge examination that uterine or pelvic infection is or has been present. In this group also, for the purposes of the paper, I include temperatures due to breasts, and one or two certain cases of gonorrheal salpingitis. In group three, cases in which there was definite evidence of uterine infection.

The result of study of these seventy-five cases of toxemia of pregnancy and convulsions which did not die showed that seventeen cases ran absolutely normal temperatures; thirty-nine cases showed slight elevation; nineteen cases were definitely septic. Roughly, 25 per cent were septic; 20 per cent ran normal temperatures throughout and 55 per cent showed slight elevation of temperature. If we include the cases that died, we find that in the whole series, 103 cases of toxemia with convulsions, something over 20 per cent, were definitely septic. If there is any error in these figures, it is on the side of conservatism, because, as my own records have shown, a certain number of cases running low degrees of temperature end with an enlarged tender tube which proves that they did have some degree of sepsis.

The series of 297 toxemias without convulsions, admitted to the hospital, is reduced in number by ten that were discharged against advice; seven that are thrown out by questionable diagnosis, usually the question of chronic nephritis, (all definite chronic kidney or cardiorenal cases were omitted in the beginning); and fifty-four that were discharged relieved before delivery. In addition to these, fifteen had no toxic symptoms at the time of delivery, but were delivered before leaving the hospital. *These figures show that of the toxemias without convulsions about 18 to 20 per cent improved enough under medical treatment to be discharged relieved, and about 25 per cent improved so that they were able to leave the hospital, or were symptom-free at the time of delivery.*

These figures reduce the series left for consideration regarding the

question of sepsis and temperatures to 222. Of these 222, thirty were definitely septic, about 14 per cent. Fifty-three per cent showed slight elevation of temperature and 34 per cent showed normal temperature throughout.

Five cases died in the series of 222 toxemics without convulsions, giving a mortality of about 2.5 per cent. Only one of these five died of sepsis, a mortality from sepsis of less than 0.5 per cent in the series without convulsions, as opposed to a mortality of 9 per cent in the series with convulsions. The causes of death in this series, other than sepsis, were one necrosis of the liver, one bronchial pneumonia, one separated placenta, one ruptured uterus from delivery.

A study of 2200 unselected control cases taken from the records in sequence showed: normal temperature 44.5 per cent; slight elevation 53 per cent; septic 2.5 per cent. Table I shows the relative degree of sepsis in nontoxemics, in toxemics without convulsions, and in toxemics with convulsions, irrespective of method of delivery, as in Table I.

TABLE I

	NORMAL TEMP.	SLIGHTLY ELEVATED TEMP.	SEPSIS
Nontoxemics	45%	53%	2.5%
Toxemics Without Convulsions	34%	53%	14.0%
Toxemics With Convulsions	20%	55%	25.0%

It is interesting to note that the "Slightly Elevated Temperature" series is practically constant.

We now come to the more difficult task of checking up the above facts which are established *irrespective of method of delivery*, by studying the methods of delivery in each series in order to show the relative risk of sepsis in toxemics in delivery by the same method. I have divided methods of delivery into six headings as follows:

1. Normal delivery and low forceps after natural dilatation. 2. Bag dilatation in which the bag alone brings full dilatation, with any other form of delivery. 3. High forceps, breech extraction, and version after natural full dilatation. 4. Manual dilatation, with or without bag, followed by any method of extraction. 5. Vaginal cesarean. 6. Abdominal cesarean.

The numbers at the top of the accompanying tables indicate these different methods of delivery.

Table II demonstrates: (1) that in toxemics with and without convulsions normal deliveries and low forceps are about one-half as frequent as in all other cases; (2) that the Voorhees bag is used nine times as often in toxemics as in all other unselected cases; (3) that high forceps and version are twice as common in toxemics as in all other

unselected cases; that some form of accouchement forcé is fifty times as common in toxemics as in other unselected cases; and that vaginal cesarean is used in toxemics very much oftener, while abdominal cesarean is slightly less frequent in toxemics than in all other

TABLE II

METHODS OF DELIVERY IN THE THREE SERIES

	1	2	3	4	5	6
Control Nontoxemics	86%	3%	4%	0.1%	0.1%	6%
Toxemias With Convulsions	40%	28%	7%	5.0%	5.0%	5%
Toxemias Without Convulsions	50%	20%	8%	5.0%	2.0%	3%
Toxemias With Convulsions That Died	40%	12%	0%	12.0%	8.0%	8%

unselected cases. It also demonstrates that when we are forced to accouchement forcé or abdominal cesarean, the mortality is higher than by other methods of operative delivery not *necessarily* from the form of delivery, but from the severity of the toxemia, since 46 per cent of the toxemias with convulsions that died were normal deliveries or low forceps.

It now becomes necessary to attempt some study of the rate of sepsis in these series according to *method* of delivery.

Table III shows in detail the amount of sepsis in the toxemics with *convulsions* that lived, according to method of delivery.

TABLE III

METHOD OF DELIVERY	1	2	3	4	5	6
Sepsis	7	3	0	5	2	1
Sl. El. Temp.	12	10	2	1	1	2
Normal Temp.	6	5	2	3	0	9
	25 cases	18 cases	4 cases	9 cases	3 cases	12 cases
Sepsis	38%	16%	0	55%	66%	25%

This table demonstrates that of the toxemics with convulsions that lived, 38 per cent of the normal deliveries and low forceps were septic; no cases in which the bag was used were septic; 55 per cent of some form of accouchement forcé were septic; 66 per cent of the vaginal cesareans and 25 per cent of the abdominal cesareans were septic. Of all sepsis in the series 38 per cent were normal deliveries; 27 per cent were some form of accouchement forcé; 11 per cent were vaginal cesareans; 5 per cent were abdominal cesareans.

Table IV shows in detail the percentage of sepsis in the toxemics without convulsions, and for comparison, the amount in cases with convulsions, according to method of delivery.

This demonstrates that sepsis is four times as common in normal deliveries and low forceps if the patient has had convulsions than if she has not: that allowing for the greater immediate mortality it is

TABLE IV

METHOD OF DELIVERY	1	2	3	4	5	6
Septic Without Convulsions	9%	21%	16%	9%	50%	35%
Comparison:—Cases With Convulsions allow 20 per cent Higher Mortality	38%	16%	0%	55%	66%	25%

still higher: that in any form of accouchement forcé it is very much higher in those who have had convulsions: that making this same allowance, it is higher in vaginal and abdominal cesarean sections and very high in these methods whether the patient has or has not had convulsions: that with other methods of delivery it is approximately the same.

Table V shows amount of sepsis in toxemics with and without convulsions according to method of delivery in detail showing number of cases:

TABLE V

METHOD OF DELIVERY	1	2	3	4	5	6
Sepsis	19	12	3	6	4	4
Sl. El. Temperature	12	31	12	12	3	6
Normal Temperature	59	24	7	5	0	1
No. of Cases	150	77	22	23	7	11
Per Cent of Sepsis	13%	16%	13%	20%	57%	36%

Table VI shows method of delivery in control series by per cent; rate of sepsis according to method of delivery in control, compared with rate of sepsis according to method of delivery in toxemics.

TABLE VI

	1	2	3	4	5	6
METHOD OF DELIVERY IN CONTROL SERIES	85%	3%	4%	.1%	.1%	7.5%
Rate of Sepsis Control	2.5%	4%	2%			13%
All Toxemics Rate of Sepsis	13.0%	16%	13%	26%	57%	36%
Toxemics With Convulsions allowing 20% higher mortality	38.0%	10%	0%	55%	66%	25%
Toxemics Without Convulsions	9.0%	21%	16%	9%	50%	35%

This table demonstrates that by similar methods of delivery, a toxemic with or without convulsions is five times as likely to be septic as a nontoxemic, unselected, if she has a normal delivery or low forceps; four times as likely if she has a bag delivery; six times as likely if she has a high forceps or version; very much more likely if

she has an accouchement forcé or vaginal cesarean section; and about three times as likely if she has an abdominal cesarean.

Roughly all toxemics are *four* to *five* times as likely to become septic as nontoxemics, unselected, with similar methods of delivery.

Toxemics with convulsions that survive are *fifteen* times more likely to become septic with normal delivery or low forceps, than nontoxemics unselected. Toxemics without convulsions are three to four times as likely to go septic with normal delivery or low forceps as nontoxemics unselected.

It is of course as obvious to the writer as to the reader that these figures are not absolute, especially in the series with a few cases; but they are suggestive, particularly in the group of normal delivery and low forceps, the bag and the abdominal cesarean section series, which are not small.

The normal delivery, bag and abdominal cesarean section series are shown in Table VII repeated for simplicity.

TABLE VII

	NOR. DEL.	LOW FORCEPS	BAG	ABDOMINAL CESAREAN
Control	2.5%	Sepsis	4% Sepsis	13% Sepsis
Toxemics With and Without Convulsions	13.0%	"	16% "	36% "
Toxemics With Convulsions	38.0%	"	16% "	25% "
Toxemics Without Convulsions	9.0%	"	21% "	35% "

SUMMARY

1. "Eclampsia" is not a "self-limited disease" except in the sense that "all things end in death" and so are self-limited. If 25 per cent of our eclamptics die, these usually coming to us moribund with the head on the perineum, the limit is somewhat too early for the patient's good. Whether treatment is active medical, or active surgical, or active both, it is always active and the term self-limited as applied to "eclampsia" should be dropped, for psychologically it leads to too much watchful waiting on the part of the general practitioner. Toxemic symptoms call for something to be done when discovered, be it medical or surgical. Some cases of everything get well if watched and let alone, but this should be forgotten in toxemia of pregnancy.

2. The mortality of toxemia with convulsions in hospital practice is 25 per cent; 90 per cent of these die within thirty-six hours of eclampsia,—whatever that is. It is, therefore, one of the most dangerous diseases from which people recover.

3. The mortality in hospital practice of toxemia without convulsions is 2.5 per cent which shows that best hospital care for these cases is none too good.

4. Uterine sepsis is responsible for 9 per cent of deaths of toxemias with convulsions that survive.

5. Uterine sepsis in toxemics without convulsions and in the nonseptic control show the same percentage mortality—0.5 per cent, but uterine sepsis is responsible for more deaths in toxemics than in nontoxemics because it is more frequent.

6. Two and five-tenths per cent of nontoxemics unselected become septic, 14.0 per cent of toxemics without convulsions become septic, 25.0 per cent of toxemics with convulsions become septic, *irrespective of method of delivery.*

7. Toxemics are about four times as likely to become septic *under similar methods of delivery* as nontoxemics, unselected. If they have convulsions, more; if without, slightly less. They are more likely to have difficult operative deliveries with a higher septic rate.

8. That these figures establish that toxemics are very prone to sepsis; that the quotation from De Lee regarding withholding salts until after delivery, or closing off the rectum if the patient has been under medical treatment and delivery is forced in the midst of it, is worthy of more attention than in general is given it.

9. That though we must be very cautious in applying these figures to methods of delivery, since sepsis is only one element in the situation, and the series of vaginal and abdominal cesareans studied here is very small, it speaks for normal labor or low forceps, and the Voorhees bag, and delivery from below after full dilatation, as against vaginal or abdominal cesarean. But certain cases are only deliverable by these methods. I, personally, believe at the present time that no toxemic with or without convulsions *making progress in dilatation,* either by her own pains, or with a Voorhees bag, should be operated to hasten the delivery, even in the presence of impending convulsions, or increasing symptoms, because of the increased danger of sepsis. I also personally believe now that a cutting operation, vaginal or abdominal cesarean, as the case may call for, should be done only in cases in which preliminary observations show an unwillingness of that cervix to dilate readily enough to take a large bag. With this exception, I think that bag induction—failing to start labor with catharsis—and allowing the patient if possible to deliver herself, or at least dilate herself fully and come to low forceps, is the choice of procedure in all toxemics with and without convulsions, controlling the convulsions as much as possible with morphia, and in selected cases in which repetition of convulsions is more to be feared than excessive hemorrhage afterwards, with blood letting. I do not believe that the amount of time saved by hurried, difficult operating through the undilated cervix is worth the risk of immediate shock and subsequent sepsis.

This conclusion should be qualified by stating emphatically that when

an introduced bag fails to work, it should be removed and delivery completed in the most appropriate way, which may be either vaginal cesarean section, or completing dilatation manually.

10. We frequently hear that hospital figures do not apply in private practice; but in the relationship of toxemia to uterine sepsis, nothing in my own work or in what I know of the work of others leads me to believe that these hospital figures are worse than private and consultation figures. That they are worse than the careful specialist's own private work is not on account of any difference in the relationship of toxemia and uterine sepsis; but because he has learned the real danger of toxemia of pregnancy, and dallies not at all with these cases. It is this point of view which all practitioners of obstetrics should get, namely, that symptoms of toxemia of pregnancy call for quick action and good judgment.

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LITHOPEDION FORMATION IN EXTRAUTERINE FETAL MASSES

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IN EXTRAUTERINE gestation the greater number of embryos are destroyed during the first few weeks of growth. Mall[1] after an exhaustive study of extrauterine pregnancy, says that in tubal implantation most ova are destroyed by the hemorrhage superinduced for their own nourishment. He states that in some few cases the trophoblastic dam is sufficient to check this hemorrhage and that enough villi remain to nourish the ovum. If rupture of a gravid tube occurs on the free side, the embryo is thrown into the peritoneal cavity and its career usually terminated. If, on the other hand, the tube ruptures into the broad ligament, the outlook for continued embryonic life is good, as here considerable surface exists for implantation and resultant proper embryonic nourishment.

Mall's study showed that more tubes containing normal embryos rupture than do tubes containing pathologic ones. According to Schumann[2] 3.3 per cent of normal embryos implanted in tubes go on to full term, 10.5 per cent become pathologic and die, 2.2 per cent become monsters, the remainder undergoing absorption. Von Winckel[3] believes that one-half the fetuses in ectopic gestations are deformed. In eighty-seven collected cases, he found fifty-seven malformations, with twelve monsters. Cragin's[4] case of full term ectopic pregnancy, though mentally normal, showed some asymmetry of the head in addition to a congenital dislocation of the hip and an umbilical hernia. That such

deformities are due to pressure has been suggested by Ballantyne.[5] Undoubtedly nutritional deficiencies induced by faulty placentation have considerable influence on such developmental abnormalities.

Many extrauterine fetuses go on to full development and by appropriate surgical interference can be removed. Schumann[2] mentions fifty such cases. When such interference is not carried out the fetus necessarily dies, and if the dead fetus is not then removed it must undergo one of several terminal changes. These changes are skeletonization, adipocere, suppuration and lithopedion formation.

Skeletonization occurs when disintegration and absorption of soft parts has taken place, with a result that only the bony parts remain to represent the fetal mass.

Fig. 1.—X-ray showing skeletal elements.

Adipocere consists in the apparent replacement of muscles and soft parts by a mass made up of a mixture of fatty acids, soaps and salts of palmitic and stearic acids. Such a product is resistant to putrefaction and will remain intact for many years.

The advent of suppuration naturally indicates the entrance of microorganisms. These, usually of the colon group, enter the sac wall by penetration from the intestines. From the sac wall the invading organisms spread to the fetus, setting up a low grade inflammation. As further changes, the fetal soft parts may undergo liquefaction necrosis; the bony parts may injure various internal organs and set up a peritonitis, or as is most usual a pelvic abscess may develop, with eventual discharge through vagina or rectum.

Lithopedion formation as the termination of a tubal or abdominal pregnancy takes place when the dead fetus is infiltrated with calcium salts, becoming as a result a more or less completely calcified and usually distorted mass. The first mention of this interesting termination of an extrauterine pregnancy occurs in Bauhin's[6] "Gynecorum." This is the classical lithopedion of Sens reported by Cordaeus in the sixteenth century. Since then Strauss[7] has collected 38 cases from

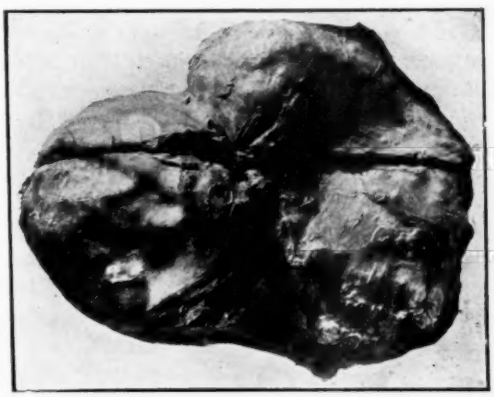

Fig. 2.—View of lithopedion as removed.

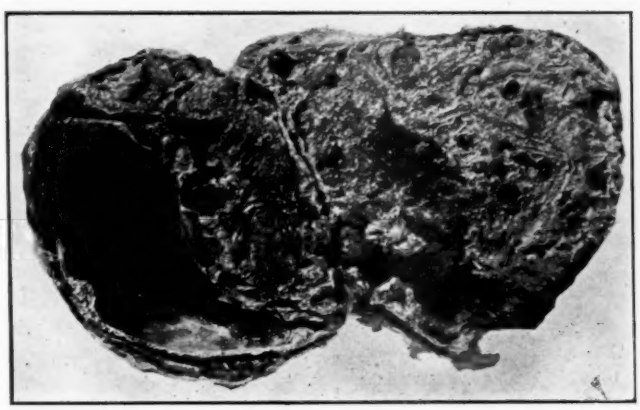

Fig. 3.—Lithopedion sectioned.

1880 to 1900. Bainbridge[8] added 36 cases to 1912. Our search of the literature from 1912 to date has resulted in the addition of 12 cases. These latter we desire to tabulate briefly.

Letoux[9] reported a calcified fetus removed by operation from a woman aged fifty-five. The patient had had two children before her ectopic pregnancy at twenty-one. She gave a history of typical signs of rupture at three months; growth continued and false labor occurred about the calculated date of delivery. The mass decreased, but did not disappear. The patient had two more normal

pregnancies and labors. At operation, thirty-four years after rupture, the fetus was found to be calcified and the membranes were fibrocalcareous.

Smith[10] reported a specimen removed at autopsy from a woman aged eighty-eight years. The diagnosis was made before death by palpation through the thin abdominal wall. The right tube was embedded in the mass, which weighed 13½ ounces, and "was apparently of four or five months' development." Patient had passed through the menopause forty-three years previously, and the author thinks that the fetus had probably been retained for about sixty years.

Fox[11] exhibited before the Tennessee State Medical Association a specimen removed at operation eight years after a "missed labor". Patient was thirty-three years old and gave a history of pregnancy eight years previously, with amenorrhea for seven months, followed by labor pains which lasted "a number of hours, when they suddenly ceased without delivery." The mass was completely calcified, and was bound down by many adhesions. Patient recovered. No note as to other pregnancies.

Tilp[12] exhibited before the Alsatian Medical Society at Strassbourg, a lithopedion removed at autopsy from a woman fifty-six years old. It was embedded between coils of the small intestine, and was adherent to the omentum and to other organs. The mass was of a stony hardness, 25 cm. long, and the author thought that the fetus had developed to the fifth lunar month. From the history and the study of the specimen, he concluded that an ampullar pregnancy had ruptured, and that the fetus had been carried for at least twenty-one years.

Schweitzer[13] discussed in detail a specimen removed at autopsy from a woman sixty-eight years old. It measured 9x5x5.5 cm., and the fetal parts were clearly discernible. The author classed it as a lithokelyphos. Patient had had one normal pregnancy.

Von Campen[14] removed a lithopedion by laparotomy from a woman aged sixty-three, who had passed through the menopause at the regular time. From the history, the author concluded that her first (and only) pregnancy was ectopic, and had ruptured at four and one-half months.

Fraser[15] also removed a lithopedion by laparotomy, which had been carried for forty-two years. The patient had had three children prior to 1870. Early in that year she became pregnant, progressed apparently normally for six months, then fetal death occurred and a firm, hard mass persisted. The patient subsequently had four more children. The head, body, fetal parts, and placenta were easily distinguished when the specimen was removed and studied. Patient recovered.

Lamb[16] records a specimen in the Army Medical Museum at Washington, which was removed by Dr. J. B. Murfree. The patient had false labor pains at eight months in the first pregnancy. A tumor formed and persisted. She had five children and died at age of seventy-eight. The specimen was removed at autopsy, after being carried for fifty-four or fifty-five years.

Biener[17] described a specimen found at autopsy in a woman fifty-six years of age. It was connected only with the great omentum, and had apparently developed to the fifth month. Microscopically, bone, striped muscle fibers, and elastic fibers were found. Examination of the woman's genitalia showed that the fetus had been expelled from a ruptured ampullar pregnancy of the left tube. It had been carried about 20 years. The author classed it as a true lithopedion, after Küchenmeister.

McMurphy and Sellers[18] removed a lithopedion from a colored woman, age thirty-seven, with a clear history of a ruptured ectopic pregnancy seven years previously. One normal pregnancy nineteen years before operation. The right tube encircled the mass; the right ovary could not be found. The tumor was hard and bony

throughout, measured 6½ x 3½ inches, and weighed three and one-half pounds. Fetal parts were easily made out. Recovery.

Luker[19] reports the removal of an extrauterine fetus covered by a bony shell, from a woman of thirty-three years. The patient had been married twelve years and had given birth to three stillborn fetuses. Three months after marrying she had suffered from a "complication of diseases." Luker believes this to have probably been the ectopic gestation from which the lithopedion resulted. The calcified fetus removed by laparotomy was 6 cm. long.

Kamoth[20] reported a calcified fetus removed by operation from a Hindu female aged thirty-five, which calcified mass had been carried for twelve years. False labor pains had supervened after ten months of amenorrhea, and the enlarged abdomen had decreased to the size of a seven months' pregnancy. The patient had had a child five years previously. The fetus was entirely calcified, was covered with a membrane (calcified also), was seven inches long, and weighed thirty-six ounces. The right tube was about 1 inch in diameter, was ruptured and was adherent to the side of the uterus. The author thinks the fetus had developed at least to the eighth month. Recovery.

Peterson[21] reported a case which, while not a lithopedion, showed a beginning calcareous change of interest. A full term ectopic gestation was carried eighteen years and was removed at operation. The fetus was skeletonized, but a portion of the cerebellum was calcified.

Schrenk[22] gives the occurrence of lithopedion in extrauterine pregnancy as eleven among 610 cases, or 1.8 per cent. Schauta[23] found nine among 626 cases or 1.5 per cent. Schumann[2] believes these figures to be too high. In his series of 207 cases there were no lithopedions. Futhermore he states that in a compiled series of 866 studied cases of extrauterine pregnancy from various sections of the country there were no lithopedions.

It thus appears that recognized or reported cases of lithopedions are uncommon, hence our excuse for reporting the present one.

CASE REPORT

Ellen F., colored, admitted 9-28-20 to Charity Hospital. Age ninety years. (This was age given by patient and family. She was apparently older in the opinion of the authors, and undoubtedly as old, this statement being made after subsequent correlation of various events concerning her early life.)

Chief complaint—dyspnea, "pain all over body." Family history—negative. Married; no children; no miscarriages; never pregnant. Past history—negative. Present illness—sudden onset, duration of five (5) weeks. Cannot eat, coughs a great deal. "Shortness of breath." Physical examination: (on admission) colored woman, well developed for age, poorly nourished. Heart—systolic blow best heart at apex. Marked arrhythmia with extrasystoles. Vessels—marked arteriosclerosis. Edema of both lungs with râles crepitant in character at base of both. Large mass felt on left side of abdomen, movable; connected with uterus and fixed in pelvis, probably a large fibroid. Sensitive, smooth, but present several nodules on surface, about 3-5 fingerbreaths above symphysis. (Says she has had this mass for last fifty years, and that it has given her no trouble.) Liver—slightly enlarged. Spleen—not palpable. Extremities—Edema with sensitiveness of long bones. Knee reflexes—diminished. Gyn. Exam.—Large mass lying posterior to uterus, and probably connected to it (leiomyoma). Temperature normal; pulse 84; respiration 24.

SUBSEQUENT COURSE

Patient became weaker day by day and was nourished very poorly. On 10-12-20 she died, fourteen days after entering ward, with diagnosis of senility, general

arteriosclerosis, cardiac hypertrophy and dilatation, acute nephritis and uterine myoma.

Necroscopy was performed with anatomic diagnosis of: General arteriosclerosis. Cardiac hypertrophy and dilatation. Acute parenchymatous nephritis. Anasarca. Edema of lungs. Chronic passive congestion of liver. Chronic splenitis. Lithopedion formation.

The following salient features are quoted from the autopsy protocol.

"On opening the peritoneal cavity there appears an irregularly shaped nodular mass lying in the pelvis, principally to the left of the median line. This mass apparently is a fibroid uterus. Further examination reveals that it is thoroughly calcified, is anterior to the uterus and does not spring from this organ but is intimately attached to it and to the intestines by dense fibrous tags. The right tube and ovary are present, the ovary being small and sclerotic. Left tube and ovary cannot be definitely located, the latter being closely adherent to the posterior surface of the calcified mass. The external outline of this mass is somewhat suggestive of the position assumed by the fetus in utero. Upon removal and further study outline of lower fetal extremities can be determined with accuracy; the outlines of the nose, chin, and superciliary ridges are readily discernible. Section made by means of the saw through the long diameter of the mass reveals; *First* the calvarium, containing semigelatinous substance through which dense fibrous cord corresponding to the dural folds can be seen; *Second*, the upper extremities, which can be readily outlined; the humerus is present, the metatarsal bones evident. The musculature is represented by a soft brownish red material; *Third*, folds of the small intestine. *Fourth*, the bony parts of the lower extremities which can be outlined without difficulty. The mass measures 15x13x10.5 cm. and weighs eight hundred grams. Its calcified envelope varying in thickness from 8 mm. to 16 mm. shows extension of calcification into fetal parts at points corresponding to lungs and soft parts of lower extremities. It is impossible to trace the left tube farther than 1 cm. from its uterine attachment. There it becomes obliterated and evidently in some manner involved in the fibrous tags which cause adherence of intestines and calcified mass. From these findings it is assumed that an ampullar pregnancy of the left tube has ruptured, the calcified mass being a lithokelyphopedion according to Küchenmeister."

THEORIES OF LITHOPEDION FORMATION

Numerous theories have been advanced to account for the process by which extrauterine fetuses became calcified. Calcification occurs but rarely in normal tissue except as concerned in the formation of bone. As a general rule it can be stated that any portion of noninfected dead tissue which on account of its size or position cannot be absorbed will eventually undergo calcification. No matter where calcification is to occur the calcium salts must reach the site through the blood in which they are held in suspension by the proteins possibly in the form of a complex double salt-tribasic calcium carbon phosphate according to Barille. In tissues which will undergo calcification the circulation is very sluggish, plasma seeping through without any erythrocytes, thus preventing active exudative changes. In such areas deposition of calcium salts depends according to Wells[24] upon "one or more of the following conditions":

(1) "Increased alkalinity or decreased CO_2 in degenerating tissue

with resultant precipitation of inorganic salts in fluids seeping through.

(2) Utilization of protein of fluids by starved tissue with result that calcium cannot be held any longer in solution.

(3) Formation within degenerating areas of substance having affinity for calcium.

(4) Production of physical conditions favoring local absorption of salts, least soluble salts accumulating in excess."

According to Lichtwitz,[25] changes in the proteins constitute the principal factor in the deposition of lime salts. These changes consist in colloidal precipitation in degenerating areas with a decrease in the amount of cystalloids which can be held in solution and a resulting precipitation of the least soluble salt (i.e.) calcium. That calcium binding substances are found in the degenerating areas is asserted by numerous investigators and given by them as the real factor influencing calcification.

Freund[26] endorses Kroemer's explanation, as to method of calcification of extrauterine fetal masses. According to them, the metamorphosis which primarily takes place in the fetus is induced by withdrawal of amniotic fluid and body juices. Adhesions between sac and fetus then take place with consequent fatty changes and calcium salt deposits at these sites. Küchenmeister,[27] though contributing little to the knowledge of the method of formation of these calcified products of conception, presents the most generally accepted classification: namely into lithokelyphos, lithopedion and lithokelyphopedion. His differentiation of these various types is as follows:

Lithokelyphos: Calcification of fetal membranes with fetal calcification only at points where adhesions between fetus and membranes have occurred during fetal life. Originates usually when fetus with its unruptured membranes is discharged into abdominal cavity.

Lithopedion: Originating by wrapping of membranes around fetus after the waters have escaped through a large tear. Calcification then begins in vernix caseosa, extending to membranes and finally to fetus.

Lithokelyphopedion: Found only in case of fetus adherent to membranes during fetal life.

Werk says that when decomposition of the products of pregnancy fails to occur, calcification supervenes as the final stage. Kieser[28] gives the most elaborate description of the calcification and as a result of his studies concludes that in lithopedion formation mummification of the fetus is the primary change with calcium deposition beginning in the maternal envelope and involving the fetus only secondarily. His explanation and further elaboration of Küchenmeister's classification is as follows:

Lithokelyphos: Fetus mummified; maternal envelope calcified and not adherent to fetus.

Lithokelyphopedion: Fetus adherent to envelope and involved in calcification process.

True Lithopedion: Fetus alone seat of calcification; deposition of lime salts being in vernix caseosa. Such masses invariably found free in abdominal cavity.

Kieser believes contrary to Küchenmeister that the type designated by this latter as lithokelyphopedion is the most common of all. As regards the course of the lime salts, Kieser holds that they are supplied from the maternal blood current, and that the deposition of calcium salts can occur only in areas readily within reach of maternal blood and tissue juices.

We desire to thank Dr. S. H. Nothacker and Mr. H. Buisson of the Department of Roentgenology for their kindness in preparing radiographs.

BIBLIOGRAPHY

(1) Carnegie Institute, Publication No. 221. (2) *Schumann*: Extra Uterine Pregnancy, 1921, D. Appleton & Co. (3) *Von Winckel*: *Handbuch der Geburtshilfe*, iii, Part I, Wiesbaden, 1904. (4) Am. Jour. Obst., 1900, xli, 740. (5) *Ballantyne, J. W.*: Manual of Antenatal Pathology and Hygiene, Edinburgh, 1904. (6) *Bauhin*: Gynaecorum sine de Mulierum Affectibus Commentarii, Basel, 1586. (7) Arch. f. Gynäk., 1903, lxviii, 3. (8) Am. Jour. Obst., 1912, lxv. (9) Gaz. Med. de Nantes, 1912, xxx, 1. (10) Jour. Am. Med. Assn., 1912, lviii, 1114. (11) Jour. Tenn. State Med. Assn., 1913, v, 351. (12) Deutsch. med. Wchnschr., 1913, p. 535. (13) *Schweitzer, Theodor*: Inaug. Dissertation. Berlin, 1912. (14) Nederl. Tijdschr. v. Geneesk., 1914, ii, 654. (15) Brit. Med. Jour., 1913, ii, 1624. (16) Washington Med. Ann., 1913, xii, 254. Brit. Med. Jour., 1914, i, 512. (Reported previously Transactions Tennessee State Medical Society, 1886, 88-85.) (17) Monatschr. f. Geburtsh. u. Gynäk., 1913, xxxviii, 428. (18) Southern Med. Jour., 1914, vii, 813. (19) Proc. Roy. Soc. Med., London, 1913, No. 14, vii, 253. (20) Indian Med. Gaz., Calcutta, lii, No. 8, p. 301. (21) Jour. Mich. State Med. Soc., 1917, xvi, 316. (22) *Schrenk*: Inaugural Dissertation 1893. (23) *Schauta*: Beiträge zur Casuistik, Prognose and Therapie der Extrauterin Gravidität, Prague, 1891. (24) *Wells*: Chemical Pathology, W. B. Saunders Co. (25) Deutsch. med. Wchnschr., 1910, xxxvi, 704. (26) Beitr. z Geburtsh. u. Gynäk., 1903, vii. (27) Arch. f. Gynäk., 1881, xvii, 153. (28) *Kieser:* Inaugural Dissertation, Stutgart, 1854, quoted from Bainbridge.

THE PREMATURE SEPARATION OF THE NORMALLY IMPLANTED PLACENTA

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PREMATURE separation of the normally implanted placenta is a condition calling for the keenest judgment on the part of the attending obstetrician. Although it is true that in the majority of cases there is no need for interference because the degree of separation is so slight as to be followed by no serious effects, in a small group, however, the life of the patient may actually depend on accurate diagnosis and the procedure chosen to meet the situation. Each such event, therefore, must be considered as an entity and the treatment should wholly depend on the conditions to be met.

The cause of premature placental separation has not been definitely demonstrated but there seems to be a definite relationship between this condition and the toxemias of pregnancy. While there are unnumbered cases of toxemia of pregnancy in which there is no evidence of placental separation, it is rare to find a case of placental separation without toxemia.

It is rather commonly agreed that the condition is not an uncommon one, but the incidence varies markedly according to different observers. One clinic reports a frequency of one case in every one hundred and eighty-six deliveries while another clinic has reported only one case in every seven hundred and fifty-six deliveries. Doubtlessly, if obstetricians reported every case, in which, after an apparently normal delivery, they found evidence in the placenta of partial separation, the incidence would be much higher than is commonly believed. In a large proportion of these cases old retroplacental clots or blackened areas near the edge of the placenta indicate that some separation has taken place shortly before or during labor, although the portion detached may not have been of sufficient extent to threaten seriously either the life of the mother or child.

The placenta may separate at any time after its formation, with the curve of incidence rising sharply during the last six weeks of gestation. The accident is more common in multiparae than in primiparae and is apparently more prone to happen if successive pregnancies have been many and close together.

This article has been prompted by the observation of ten cases, three of which presented unusually extensive pathologic lesions. This

is a small series of cases but it was felt desirable to place them on record, together with an analysis of the salient points in order that they may be developed farther or at least be given consideration in any more comprehensive study of this condition.

GENERAL CONSIDERATION OF ETIOLOGY

The causes suggested for accidental separation of the placenta are numerous but those given most consideration may be catalogued as follows: (1) a short cord; (2) a short and severe, or unduly prolonged labor; (3) direct or indirect trauma; (4) syphilis or any form of nephritis; (5) persistently high temperature from any cause; (6) certain toxemias of pregnancy.

Most writers are willing to concede that a short cord may be the cause of separation of the placenta in a few instances but it is generally believed that the importance of this factor has been greatly overrated. J. Whitridge Williams[1] refers to the fact that "in the classical specimen which is figured in the Atlas of Pinard and Varnier the accident was attributed to traction upon the placenta by a relatively short cord." It would seem, however, that if the short cord is to have much effect it must be at the expulsive stage because at that time only will traction be exerted, for at other times the uterus and fetus move synchronously together in the same common direction with each contraction. The possibility of separation occurring from this cause must, of course, be admitted but Essen-Moeller[2] found that traction on the cord will rupture it before it will loosen the placenta. It is probable that every obstetrician can remember one or more cases in which the cord was short enough to cause symptoms of fetal distress during labor as evidenced by the irregularity of the heart rate, although the traction on the cord failed to detach the placenta. It is apparent therefore that if the short cord plays a part in this condition it does it so rarely that for all practical purposes it may be disregarded as an etiologic factor.

In cases where the labor is of the fulminating type and the pains are severe, the fetal heart may noticeably increase in rate and cause some anxiety for the safety of the infant. On deliverance of the child the placenta may come away almost at once because it has been loosened with the first violent pains. Thus it is possible for it to have been separated, somewhat after the manner and mechanism of the Credè maneuver whereupon it would be promptly extruded. This may likewise occur after the administration of pituitary extract late in labor if, as so often happens, the contractions become severe or tetanic in character. Under such circumstances the baby is born with the placenta trailing along almost immediately behind. The infant is delivered in beginning asphyxia and the physician congratulates himself that he administered pituitary extract at the opportune mo-

ment, when as a matter of fact the infant's condition is due to partial separation of the placenta plus the shutting off of the blood supply caused by the severe contractions induced by the drug. Occasionally in unduly prolonged labors, the placenta will be found completely detached with no other cause to account for the condition but they may be with propriety excluded from those which are considered as definitely abnormal, rather than merely accidental.

A few cases may present all the signs of separated placenta who give a history of trauma. The story may be that they have been riding in a train or an automobile and thus jolted or shaken, or there has been direct trauma to the abdominal wall. It may be, as some of the older obstetricians think, that in these few cases chronic endometritis plays a part. Meyers, as quoted by Ahlsrom[3] believes that traumatism may initiate severe uterine contraction or even hemorrhage into the decidua thus causing placental separation. In many cases composing this relatively small group there is nothing else to account for the condition, so we are forced with such a history to accept this as a cause for placental separation although we do it with mental reservation.

In the outline of the causes given above, syphilis, nephritis, fever, and toxemias of pregnancy may be classified under the main heading "toxic type" of placental separation and as such will be discussed under the cases reported.

Considered from an etiologic standpoint, I believe there are only two types of placental separation, one of these may be called, for want of a better name, the traumatic type. In this group are included those cases which have a definite history of trauma, as well as those in which there is placental separation without demonstrable cause, as for example, the apparently healthy women who repeatedly abort. The other group, which is by far the larger and more important group is nearly always associated with toxemias and so may be termed the "toxic type."

It is immediately apparent that the general principles expounded and the theories advanced are not new, but such a strict limitation of the causes of placental separation is in marked contrast to the generally vague and indefinite ideas offered whenever the question arises in any given case as to why the accident occurred. I feel that sufficient evidence can be presented to indicate if not actually demonstrate, that practically such cases of separation are due either directly or indirectly to toxic processes. For example, the infarct is a result of an irritating process which finally blocks off a portion of the placenta and the sudden separation occurring in the severe toxemias is the same process from a standpoint of cause only carried out instantaneously. It is an accepted fact that fibrous tissue appears as a reaction to an irritative process and if a section be made through a placental

infarct the vessels will be found to be quite completely surrounded by a thick coat of fibrous tissue while in some portions they are entirely thrombosed. It seems reasonable to assume that the reaction in the fulminating cases is the same, only carried out more swiftly.

J. Whitridge Williams[4] states that the primary cause of infarct formation in a great majority of cases is to be found in the primary endarteritis of the vessels of the chorionic villi, due to a coagulation necrosis of the portions of the villi just beneath the syncytium with the subsequent formation of canalized fibrin. As the process becomes more marked the syncytium likewise degenerates and is converted into canalized fibrin which is followed by the coagulation of the blood in the intervillous spaces. This results in the matting together by fibrin, of one larger or smaller groups of villi. Later the entire stroma of the villi degenerates so that eventually the infarct consists of a massive network of fibrin.

It will be commonly agreed that endarteritis is present in all cases and the arterial changes are identical with those observed in obliterating endarteritis in other parts of the body. Endarteritis pathologically is caused by some toxic agent, either mechanical or biochemical. In the case of the slow infarct the agent is working leisurely due to its low potency while in the termed fulminating type, a terrifically toxic agent is working almost explosively in the blood stream. It has been shown repeatedly that there is an easy transmission of blood soluble substances by virtue of the process of osmosis between mother and child, and if the toxic agent is a proteinogenous amin, transmission from the maternal to the fetal blood stream or vice versa, with its resulting destruction of end vessels, is definitely possible. Bigler[5] in commenting on the failure of the various tests of pregnancy remarks that it has been impossible to induce anaphylactic reactions in the maternal organism with serum from the fetus. He thinks that the pregnancy toxin is not a ferment but more of the nature of a proteinogenous amin. These amins he considers the product of an atypical proteolysis in the placenta itself. He feels that the problem of pregnancy toxicoses is to be sought for in chemistry rather than in immunology.

The query of course arises as to whether the endarteritic processes result from the inability of a defective kidney to eliminate ordinary waste products or whether the trouble is due to toxins eliminated by the fetus plus the defective excretory function. It cannot be insisted that it is purely a defective excretory function for in the fulminating cases there is no evidence of previous difficulty and after the acute illness is over no apparent permanent damage is left. The conclusions of Prutz as stated in Williams' Obstetrics[6] emphasize the point that we must not lay too much stress on the kidney as cause. He says "Notwithstand-

ing the frequency of kidney lesions we are not justified even in the majority of cases in considering them as the anatomic substratum of eclampsia for in many cases they are too insignificant." Accordingly, it must remain a question as to whether they are not purely secondary in many cases. If we consider the slow infarct process as being of the same type as the rapid and fulminating, the question may also arise as to why separation occurs in one case when in another the placenta becomes so densely adherent as to be a part of the uterus itself. A section through the placenta and uterus will show how difficult it may be in these latter cases to distinguish the line of union between placenta and uterus. The most rational explanation of this is that, in cases of separation the infarct has been on the placental side and the hemorrhage has dissected its way between the uterus and placenta. In the type that has the firmer attachment the infarct has occurred on the uterine side and as a fibrous ball has sunk into the uterus, locking placenta to the uterine wall and making hemorrhage between the two as practically impossible.

GENERAL CONSIDERATION OF TREATMENT

The treatment of placental separation can be narrowed down to two, depending upon whether the patient is a primipara or a multipara and whether the hemorrhage be severe or moderate.

If the hemorrhage is not alarming, as is often the case, rest in bed with enough morphia for relaxation may be sufficient. If, on the other hand, the bleeding is at all severe whether appearing externally or not, it is at once necessary to empty the uterus speedily. Under such circumstances the baby need not be considered, for the majority of them are already dead and the mother's life is of prime importance. It goes without saying that accurate and early diagnosis is essential and seldom will earlier diagnosis fail to be made if the obstetrician is giving the patient proper prenatal care.

The method of delivery to be chosen is often influenced by the parity of the patient. If she is a multipara there is an opportunity afforded for somewhat more conservatism than if she were a primipara. It may be felt that in a given case, provided the patient is a multipara and in fairly good condition, that merely rupturing the membranes artificially will allow the uterus to contract sufficiently to control hemorrhage and at the same time hasten labor. This may also be an aid, if the labor is already progressing, but otherwise valuable time may be lost awaiting the outcome of such an uncertain procedure. The use of bags too may be slow and uncertain. Manual dilatation may be considered when the cervix is soft and lax, remembering always that manual dilatation usually means laceration and is therefore dangerous. The Rotunda method of vaginal packing has

been well recommended but its benefit is questionable and at least in one case reported here valuable time was lost by the procedure. It goes without saying that the introduction of a gauze pack in the vagina for any time, means a definite increase in the chances of infection.

Kellogg of Boston states that cutting operations should be avoided whenever possible in toxemia, because there is a higher percentage of sepsis than in normal pregnancies, due probably to the lowered resistance to infections. There are times when section is the only safe and ideal method for emptying the uterus. In many primiparae, as well as some multiparae, the cervix is rigid and closed and there is no other method which permits rapid delivery. In cases where the infant is not over seven months and is not too large, where the cervix can be pulled down comfortably, vaginal section is the operation of choice. It should be done by skilled men in a hospital and when so carried out is ideal, for the patient may be delivered with little or no additional loss of blood. In other cases where the infant is too near term or too large to be delivered by vagina, abdominal cesarean is the operation of choice and in some cases the only choice because the uterus may be of the type which requires removal, a decision only that can be made when the abdomen is opened. Williams was the first to point out its advantages in his detailed reported results. They may be summarized by saying that abdominal cesarean affords a speedy and easy means of delivery and at the same time offers more information regarding local conditions than any other method of delivery. If the interstitial hemorrhage has damaged the uterine wall so extensively that the uterus cannot properly contract and thus stop the bleeding after the removal of the fetus, the exposure accomplished by section will immediately make this evident by both the appearance and action of the uterus. The organ will have a peculiar ligneous feeling, doughy in spots and will not contract well despite the use of pituitary extract or vigorous massage. Hysterectomy under these conditions is the only treatment and with the abdomen open the field is ready for such an emergency. The uterus can thus be removed immediately and the patient spared the risks of other slower methods of delivery termed "conservative" which really are not conservative but definitely dangerous. One case of this type is usually impressive enough to make the operator feel certain that abdominal section is the only way to handle such patients. There are of course a certain number of patients who do not survive the shock of section but it is usually because the diagnosis was made late and they would not have survived under any conditions. Supportive measures such as transfusion before operation are to be reserved as necessary, but here again the judgment of the operator must play the important rôle.

CASE REPORTS

CASE 1.—Mrs. K., multipara, thirty-six years old, in her third pregnancy, advanced to the latter part of the eighth month. She had reported every two weeks and nothing in the way of abnormality noted. At her last visit, two weeks before entering the hospital it was thought that there might be a twin pregnancy. Just before entrance she had gone to bed feeling quite well. About three o'clock in the morning she arose to urinate and after she had gotten back into bed noticed that she was bleeding. She bled moderately for two hours and then called a doctor. He was in doubt as to the accurate diagnosis but insisted that she enter the hospital. She hesitated for some time and during the delay the doctor noted that her uterus was becoming larger and more tender. The fetal heart had become irregular and had risen in rate from one hundred and thirty to one hundred and sixty. The patient's pulse had risen from sixty-four to ninety-six and she was complaining of pain in the left lower quadrant. She entered the hospital and a diagnosis of separated placenta was made. Since the cervix was soft, easily admitting two fingers, and easy to manipulate, it was decided to manually dilate and deliver. Two babies were born, one dead and one resuscitated with difficulty. During delivery a large amount of both clotted and fresh blood was evacuated. Since the uterus did not react promptly the hand was introduced into the uterine cavity and about half of the placenta was found to be free. When delivered half of the placenta was covered with old and new blood clot. The patient was discharged on the fifteenth day after an uneventful convalescence. Her blood pressure was 115/75 and there were no urinary findings to suggest a kidney lesion.

CASE 2.—Mrs. N., a primipara, twenty-seven years old, seven and a half months' pregnant. Her pregnancy had been uneventful and she was feeling well. She had travelled seven hundred miles by train and during the latter part of the journey had noted some vaginal bleeding. There had been no particular jarring or rough riding and she could assign no cause for the hemorrhage. On her entrance to the hospital she was in fairly good condition with a pulse of one hundred and twenty, respirations twenty, but she was pale and looked as though she had lost a good deal of blood. Her uterus was boggy and tender, well up under the costal margin while the fetus was palpated with difficulty and no fetal heart could be detected. There was a moderate amount of vaginal hemorrhage. Examination revealed full dilatation with the head lightly engaged. Internal podalic version was easily carried out and a large amount of fresh blood came away with the delivery of a dead baby. The placenta was completely detached but some membrane remained behind and as much as possible was removed manually. The uterus did not react well and pituitary extract and ergot were used intramuscularly. It still failed to react and after a hot douche was packed tightly. Because of her depletion she was given pectoral saline. She rallied well and her convalescence was uneventful. Forced feeding and iron given intramuscularly caused rapid improvement, so that she went home in fair condition although still somewhat anemic. She was seen four months later and was well although she had bled a little after leaving the hospital. Eighteen months later she was delivered of a full term child after an uneventful pregnancy and labor. During both these pregnancies she never showed any kidney disturbance and the urine was persistently negative.

CASE 3.—Mrs. T., primipara in the last month of her pregnancy. She had always been well and had no serious illness earlier in life. During her pregnancy she had been seen frequently by her physician and apparently was well.

For a week prior to entrance she had been troubled by swelling of the hands and feet together with some slight vaginal bleeding. During the thirty-six hours before entrance she had been having rather alarming vaginal bleeding with beginning tenderness in the lower abdomen. The baby had been noticeably more active for the last twenty-four hours but she had felt no movements for the last three hours. By the time she had arrived at the hospital the abdominal pain had become acute and almost unbearable. In addition she said that she had a headache which was driving her insane.

Examination showed a well developed woman with slight edema of the face, hands and feet. There was slight systolic murmur at the apex not transmitted. The pulse was ninety, the respirations twenty-two, and the blood pressure 130/82. The urine was loaded with albumin, and granular, blood, and occasional hyaline casts. The fundus of the uterus was just below the costal border and although tense and tender seemed to relax and soften at regular intervals. The fetal heart and position could not be made out. Vaginal examination showed three fingers' dilatation, a vertex presentation and a deal of clotted and fresh blood. A diagnosis of separated placenta was made and the membranes ruptured. Labor went on rapidly and the patient delivered herself of a dead fetus two hours later. The placenta was immediately expressed being free in the uterus. It was small and had numerous infarcts interspersed with normal placental tissue. There was abundant evidence of recent hemorrhage and no evidence of lues. Autopsy of the baby showed slight petechial hemorrhages over the lung coverings and subserous hemorrhages in the heart, brain, and kidney. The patient was given eliminative treatment with the usual diet for nephritics and she left the hospital two weeks later with a blood pressure of 112/72, a negative urine and nothing to indicate a kidney damage.

Case 4.—Mrs. C., primipara, twenty-seven years old, in the eighth month of gestation, well until she began to bleed just prior to her entrance to the hospital. She had been properly cared for, having been seen by her physician every two weeks for general observation and for urinary analysis. Four weeks before this time her urine showed a slight trace of albumin and an occasional granular cast. She entered the hospital in active labor, the pains coming every five minutes. Her uterus was slightly tender and she complained that she was "sore," indicating the lower left quadrant. The uterus did not react particularly well between pains but the position was a left occiput anterior, the head well engaged, the fetal heart 136, strong and regular. There was nothing sufficiently abnormal to warrant active interference and she was allowed to go on under surveillance. Four hours later there was a sharp vaginal hemorrhage and her uterus became more tender while the fetal heart rose to 160, irregular. When the service was called in consultation no fetal heart could be made out and the uterus was tender and boggy. The cervix would barely admit one finger so the Rotunda method of packing vaginally was used and she was allowed to go on under careful watching. Three hours later she was delivered of a dead baby. The placenta was completely detached and a large amount of fresh and clotted blood followed delivery. The uterus reacted after pituitary extract and ergot was given intramuscularly but so slowly that uterine packing was deemed wise. During the first ten days of convalescence the uterus showed a tendency to relax and for that period fluid extract of ergot was given four times daily. The placenta showed two infarcts about nine centimeters in size together with numerous fresh and old clots. The patient was discharged apparently well on the eighteenth day still showing an occasional hyaline cast and a trace of albumin. Two months

later the condition still persisted so it seems fair to assume that a permanent kidney damage resulted from this pregnancy.

CASE 5.—Mrs. G., multipara, thirty-eight years old, in the eighth month of her eighth pregnancy. Her pregnancies had been close together coming at intervals of approximately eleven months. She had not seen a physician during this pregnancy and had been doing her work and feeling well up to the present time. The baby had been active for the past month but during the last week she had felt no movement at all. She had been working hard and four hours previous to entrance to the hospital had felt a severe pain in her right side which was distressing enough to force her to bed and call a physician. The doctor made a diagnosis of separated placenta on his arrival and ordered her to enter the hospital at once. The delay ensuing was an hour and a half. Examination at the hospital revealed an unusually distended and tender abdomen. Neither position nor fetal heart could be made out. Her clothes were soaked with blood, her pulse was one hundred and thirty-six, her mucous membranes were pale and she was restless, perspiring and very thirsty. Vaginal examination revealed a completely dilated cervix with a head slightly engaged. Version was easily accomplished and a dead child delivered. A gush of blood came away at once and the placenta was born before the cord could be clamped. The placenta was small, and one-half of it infarcted while the other half was covered with fresh and old blood clot. Convalescence was uneventful, except that the patient passed small amounts of urine with a fixed gravity of 1.016. She insisted on her discharge the tenth day after delivery and at that time the urine still showed a slight trace of albumin with an occasional hyaline cast, while her blood pressure was 138/76. It would not be accurate to say that a kidney lesion existed, for the patient was never seen again and whether she would show symptoms of kidney degeneration for some time, two months for example, could not be stated.

CASE 6.—Mrs. M., multipara, forty-one years old, in her sixth pregnancy and due in two weeks. She said that she had always been well but admitted that her family physician had been taking care of her over a period of two years for kidney trouble. This pregnancy had apparently been normal until eight days before entrance when the baby had begun to be very active and she had developed severe frontal headache. Her doctor had seen her from time to time but had never examined her urine or taken a blood pressure. For the last four days her headaches had been more severe and the fetal movements had ceased. For the past two days coincident with the headaches had come "flashing lights." Her physician sent her to the hospital because he "could not hear the baby." On entrance careful questioning brought out the fact that for a week past her face, hands and feet had been edematous, and twelve hours prior to entrance she bled about a cupful of bright red blood, per vagina.

Examination showed a stout, well developed woman, markedly edematous. The fundus of the uterus was two fingers' breadth below the costal margin, the position was a left occiput anterior, no fetal heart could be detected. The blood pressure was 215/120 and the urine was practically solid with albumin, loaded with casts of all description. The eye grounds showed a few scattered hemorrhages with a slight blurring of both discs. A diagnosis of beginning separated placenta was made, and this together with the toxemia present made immediate induction of labor the logical procedure. A Voorhees bag was used and the cervix was so soft that it easily delivered in an hour, allowing a simple version to be carried out. The fetus was about eight months and macerated. The placenta was free except for a small porton and was quickly delivered. It was com-

pletely infarcted, except for a small portion about three centimeters square. After the usual eliminative treatment and bland diet for sixteen days the patient left the hospital with her eye symptoms well cleared up. Her urine still showed small amounts of albumin and an occasional hyaline cast. Her blood pressure was 150/80. Her phthalein function test was fifty-five per cent and her eye-grounds still showed the typical nephritic picture. In this case it was assumed that the patient had a previous kidney lesion.

CASE 7.—Mrs. C., multipara, thirty-eight years old, in her fifth pregnancy and at the beginning of the eighth month. She had always been well except that during the last two years she had been getting stout. Her previous pregnancies had been quite uneventful and this one had been normal up until her present difficulty. Her membranes ruptured and for this reason she called a physician. He made a vaginal examination, found her bleeding, decided that she had a placenta previa and recommended entrance to the hospital. Physical examination aside from the pregnancy was negative. Her uterus, however, was tender and tense in the upper right quadrant. Although she insisted that she was only seven and a half months' pregnant the uterus was well up under the costal margin. No fetal heart could be detected and abdominal palpation was unsatisfactory. Vaginal examination revealed a soft, easily dilated cervix, filled with blood clot, this probably accounting for the diagnosis of previa. A diagnosis of separated placenta was made and because two fingers could easily pass through the soft, easily dilatable, cervix, it was decided to dilate slowly and deliver, The thick abdomen made external manipulation difficult. In bringing down a foot the right side of the cervix was torn deeply into the vault. A dead baby of seven and a half months was delivered and the placenta was found completely detached. A large amount of both fresh and old blood clot was expressed and the uterus was packed for safety's sake. The patient was put back to bed in good condition and her pulse promptly dropped from one hundred and thirty to eighty-four. Her blood pressure was 118/75. A red count showed 2,860,000 erythrocytes with a hemoglobin (Sahli) of 55 per cent. For the first seven days she had an elevation of temperature to 101° but finally recovered and was discharged in good condition on the eighteenth day. The results of her cervical repair were satisfactory. At discharge the urine showed a very slight trace of albumin with a few scattered hyaline casts and her blood pressure was 142/78. It was assumed in this case that a previous kidney lesion existed.

CASE 8.—Mrs. S., a primipara, twenty-one years old. She had been carefully followed throughout her pregnancy and had reported every two weeks for observation and urinalysis. She was last seen ten days previous and at that time the urine was negative and the blood pressure 114/76. She was feeling well, had no complaints and the baby was active, this being the last month of her gestation. On the morning she entered the hospital she had arisen at the usual hour and was preparing breakfast when suddenly she had an uncommonly sharp pain in the abdomen. The pain continued to grow worse and she was forced to go to bed. Shortly after retiring she noticed a slight amount of vaginal bleeding. Two hours later she began to feel faint and realized that her abdomen was becoming larger and more tender. Examination showed a well developed woman, distinctly pale, holding her abdomen and complaining of constant and violent pain. Her blood pressure was 98/76, pulse 140, and respirations 28. The uterus was well up to the costal margin and quite tender and tense. No fetal heart heard. The diagnosis of separated placenta was apparent from the history and

the findings, and the condition of the patient plus the fact that she was a primipara made abdominal cesarean the operation of choice.

When the uterus was opened the baby literally floated out with a gush of blood and the placenta was completely detached. Grossly it showed no marked changes. There were a few hemorrhagic changes in the uterus, especially in the anterior wall, but it reacted so readily that hysterectomy was not considered. The patient had an uneventful convalescence except that for the first five days she showed a slight degree of jaundice and some tenderness over the hepatic region. Her urine at entrance contained a large trace of albumin with various casts but two weeks later it was completely cleared up and when examined two months after delivery was still negative. It is fair to assume that this patient did not sustain any permanent kidney damage.

CASE 9.—Mrs. B., multipara, thirty-six years old, in her sixth pregnancy, at the beginning of the eighth month. Her past history was uneventful, the first four pregnancies terminating normally, and the fifth resulting in a miscarriage at the tenth week. She said that she had never seen a doctor until the present trouble. At the beginning of this pregnancy she was bothered with severe nausea and vomiting but it cleared up at the third month. She had been troubled with headaches and constipation at frequent intervals. Four days before arrival at the hospital she had a violent attack of vomiting with severe headache and her hands, face and feet began to swell. For the last thirty-six hours she had been bleeding from the vagina. Fetal movements had been quite violent twenty-four hours before entrance but she had noticed none for the last twelve hours. She said that her abdomen had grown distinctly larger and for the last three hours she had been feeling faint. A diagnosis of separated placenta was made on the history and findings but operative procedure was postponed because of the rather precarious state of the patient. She was put on toxemia treatment, her stomach washed out, the colon irrigated, and glucose given by mouth and proctoclysis. This was done because of the marked trace of albumin in her urine, despite the fact that her blood pressure was only 112/78. Twelve hours after entrance she was decidedly a better operative risk. Her abdomen had increased in size meanwhile and was more tender. The uterus had the peculiar ligneous feeling spoken of by Williams, and as a result the abdominal route was chosen for delivery so that hysterectomy could be carried out in case the uterus failed to react. Classical cesarean was done and the uterus was found filled with blood. The placenta was completely detached and a dead fetus, approximately eight months' gestation, was delivered. The uterus was plum colored, felt like a wet sack and would not react even when pituitary extract was injected directly into the uterine wall. The operator felt that he was dealing with the typical hemorrhagic uterus and immediately decided upon hysterectomy. For eight hours following the operation the patient was in precarious condition and finally transfusion was resorted to as a means of combating shock and loss of blood. She rallied well, became mildly septic, but finally was discharged six weeks after entrance. When she left the hospital there was no evidence of kidney lesion and she seemed well in every way, despite the ordeal she had been through.

Sections through the uterus showed hemorrhages widely scattered in the musculature, more marked anteriorly than posteriorly. Some of the hemorrhages were massive enough to separate the muscle and produce clots. There was a marked edema of all tissue and in some places an extensive infiltration of leucocytes suggested an infection or injury by a toxic agent with beginning repair.

CASE 10.—Mrs. O., primipara, twenty-six years old, considered herself between six and seven months' pregnant. She said that she had never had any serious

illness, nor had she been troubled with either throat or dental infections. From the beginning of her pregnancy up until five weeks before entrance to the hospital she had been well except for occasional nausea and vomiting. Then she noticed that her hands, face and feet were swelling. Two days before coming to the hospital she began to develop severe frontal headache with flashing lights before her eyes. She was markedly edematous and although she said that she only weighed one hundred and sixty pounds, the edema made her appear to weigh much more. She was complaining bitterly of flashing lights before her eyes and frontal headaches. There was a faint systolic murmur over the apex of the heart, not transmitted. The fundus of the uterus was just above the umbilicus and the position an L.O.A. with the fetal heart 144. Vaginal examination revealed a soft, easily dilated cervix, admitting one finger. The blood pressure was 178/110 and the urine loaded with albumin and all manner of casts. Immediate delivery was considered, but because of religious prejudices and the fact that she was a primipara it was compromised and she was allowed to go on for twenty-four hours under careful observation. Meanwhile she was given copious colonic irrigations of sodium bicarbonate solution, her stomach washed out, an ounce of magnesium sulphate given every four hours, morphia grain ¼, and seventy-five grammes of glucose in three hundred cubic centimeters of normal saline was given intravenously, allowing thirty minutes for it to run in, while in addition two ounces of ten per cent glucose was given every two hours by mouth and all other food stopped. When seen the next day, eighteen hours after entrance, she said that she was much better and she looked and seemed better. Her bowels were moving freely, the headaches gone, and the eye disturbances had practically disappeared. Her blood pressure remained at the entrance figure and her urine was unchanged. She was so decidedly better that it seemed to be fair to wait a little longer because she was anxious for a living baby. She was given a second dose of glucose and at this time 150 c.c. of blood was withdrawn, the blood clotting so rapidly that no more could be withdrawn. The glucose solution had hardly been started when it was noticed that the patient was cyanotic. An hour and a half later she had a chill which lasted for twelve minutes and her temperature promptly rose to 103°. She quieted down after a little time and the symptoms were attributed to glucose. Not long afterward she complained of epigastric pain. When seen she was propped up in bed, grunting with each breath and attempting to belch gas. She remarked that she had had similar attacks before and had always been relieved by vomiting. No definite tenderness could be made out and after washing out her stomach and giving a quarter of a grain of morphia she seemed relieved and quickly fell asleep. She slept throughout the night and the next morning at eight o'clock, fifty hours after entrance, the interne was called by a nurse who said that the patient had a temperature of 95° and looked bad. Fifteen minutes later the patient was in severe shock. Her pulse was 136, of poor quality and easily obliterated. Her blood pressure was 130/70 and for the first time there was a little external bleeding. The abdomen was tense and tender, the uterus well above the umbilicus and much larger than at entrance. The diagnosis of separated placenta was at once made and a hurried delivery attempted. The patient died before the anesthetic was started. The fetus was delivered dead and the placenta was found completely separated but showed no gross infarcts or changes. When the abdomen was opened a moderate amount of bloody fluid was free in the peritoneal cavity. The uterus was soft, pulpy and plum colored with many small hemorrhagic areas throughout. In addition the kidneys, adrenals and small intestine showed widely scattered petechial hemorrhages. The liver itself was riddled and there was scarcely any

normal tissue left. The end vessels with their endothelial linings were destroyed and it seemed as though some substance had suddenly ruined the vessel walls and allowed the hemorrhage to go through them. Autopsy of the baby presented a similar picture in brain, kidney, spleen, adrenal, lung and intestine.

ANALYSIS OF CASES

The cases as presented group themselves rather strikingly into two main classes. Cases one and two fall into the first or "traumatic group" and cases three to ten comprise the second or "toxic group." This latter group may be subdivided according to the rapidity of the process. In cases three to seven inclusive, the toxic action was gradual but nevertheless increased in speed and steadily, while in cases eight to ten inclusive the process was rapid enough to be termed fulminating.

In case one it is difficult to find a cause for the accident unless it be that the twin pregnancy caused an overdistention of the uterus and so brought about the separation. In the second case, no demonstrable cause can be assigned unless the trauma of the train journey can in some way account for it. It may be as Morse[7] suggests that here there was torsion enough of the uterus, due to its mobility, to cause a venous interference, with stasis, back pressure, hemorrhage and the consequent loosening of the placenta. The argument that there is definite obstruction in cases where by multiparity, for example, undue mobility of the uterus, together with torsion, might account for the few otherwise apparently inexplicable cases of separation. It certainly does not apply, however, to those cases where hemorrhages are found not only throughout the uterus, but also throughout the liver, adrenal, kidney, brain, spleen and intestine.

In cases three to seven inclusive, a definite kidney lesion apparently has some relationship to the condition. All these cases excepting number three, show a definite and permanent kidney damage which was not an acute affair. It preceded rather than followed the placental infarction. The placentas of all showed infarcts ranging in size from a half inch up to what was practically an involvement of the entire placenta. The portions of the placenta not infarcted showed a definite increase of fibrous tissue suggesting an irritative endarteritis which would in time involve the whole placenta.

If it is acceptable that nephritis may be secondary to the irritative effects of toxins, this same type of process may be thought of as taking place slowly in the infarction of the placenta or very swiftly in cases of abrupt placental separation. A slight irritation and then the plugging of the delicate end vessels is begun. Thrombosis very speedily follows by reason perhaps of the enclosure of fetal cells or the reparative formation of connective tissue. It is possible that in the cases reported by Morse[8] in which there was an increase in con-

nective tissue that this was merely an attempt at a reparative process following the toxic irritation.

In patients where the so-called placental apoplexy has taken place there may be a combination of hemolysis throughout the blood vessels due to toxins together with the bursting of the end vessels from a sudden rise in blood pressure. With the evidence thus far collected the most rational explanation which can be offered for the simultaneous hemorrhages in the uterus, brain, liver, spleen, kidney, adrenal, intestine and other organs, is that there is a sudden accumulation in the blood stream of violent toxins which directly injure the delicate endvessels of the structure affected, so that this, with a change in the viscosity and coagulability of the blood which they likewise produce, may bring about the mechanical and biochemical conditions necessary to permit these widely scattered hemorrhages. The organs affected are those in which the terminal vessels consist of practically nothing but endothelial vessels with a slight amount of connective tissue. Furthermore these local hemorrhages are not peculiar to the condition with which the paper is particularly concerned, but resemble strikingly the petechial hemorrhages produced by the violent septicemias and the lesions produced by the venom of rattlesnakes or cobras. It is fairly well known that the venom of the snakes mentioned speedily destroys the cells of the liver, spleen and kidney, acting especially upon the endothelial cells lining the vessels. It has the property of digesting coagulated blood, destroying the coats of vessels, penetrating muscle and raising blood pressure. Neurotoxin is one of the chief components of the poison and raises the blood pressure probably because of its irritative effect upon the nerve centers in this way being again comparable to the action of the toxins of the disturbances in pregnancies. In the last three cases something of this sort apparently happened.

It is of interest in this connection to note that Prusak-Tuna[9] have shown recently that the blood of pregnant women suffering from nephritic conditions will hydrolyze normal placenta and liver to a striking degree, kidney and adrenals to a lesser degree.

SUMMARY

1. The premature separation of normally implanted placenta is more frequent than is commonly believed.

2. Complete separation of the placenta is a grave condition calling for both skill and good judgment on the part of the attending obstetrician.

3. Etiologically classified, there seem to be two main groups of cases, (a) a small indefinite group which for the want of a better name may be called the "traumatic group"; (b) the "toxic group" so named because the patients usually show varying degrees of toxemia,

which is so considerable that it could not be merely termed mild but may always be spoken of as moderate or severe.

4. Mild toxemias may act slowly and be responsible for the partially separated placentae or even those which separate almost entirely with all the warning that is given by days of moderate bleeding and other symptoms. These placentae show more or less infarction which apparently seems to be the result of attempted connective tissue repair of the end vessels after the irritative toxic effects.

5. The causes of abruptio placentae or placental apoplexy show the same process raised to the *n*th degree. The process is fulminating because the toxin is rapidly formed and poisonous. Its action may be compared to that of snake venoms or the toxins of violent septicemias. There is apparently a corrosive action on the endothelial blood vessels, the coagulability of the blood is disturbed and hemorrhages are still further favored by the sudden rise of blood pressure. Hemorrhages occur not only in the uterus but also in all other organs containing vessels of the endothelial type.

6. The treatment is expectant if the disturbance is only moderate, whereas the patient should be delivered promptly if the condition is at all serious. A method of delivery should be chosen which seems to offer the patient the greatest security, cesarean section usually being given the preference in fulminating cases where one suspects an unresponsive uterus because it not only gives a speedy method of delivery but because it gives more information regarding the prospects of the patient and permits hysterectomy if necessary.

(Since the preparation of this paper we have seen seven more cases all of which fall under the toxic group, three of which were fulminating in character and the four of the slow infarcting type. The histories in each case together with the findings add additional weight to the view presented in this paper.)

I wish to express my thanks to Dr. Franklin S. Newell, of Boston, for the privilege of reporting two cases seen by me during a service at the Boston Lying-In Hospital.

REFERENCES

(1) Surg., Gynec., Obst., xxi, 541. (2) Surg. Abst., xviii, 61. (3) Surg. Abst., xxix, 208. (4) Johns Hopkins Hospital Reports, ix, 455. (5) Schweiz. Med. Wchnschr., October, 1920, 1, No. 43, 968. (6) *Williams:* Obstetrics, Chapters on Toxemia and Eclampsia (7) Surg. Gyn. Obst., xxvi, 133. (8) Surg. Gyn. Obst., xxvi, 133. (9) Surg. Abst., xix, 279.

805 HIGHLAND BUILDING.

GYNECOLOGIC OPERATIONS UNDER LOCAL ANESTHESIA*

By Robert Emmett Farr, M.D., F.A.C.S., Minneapolis, Minn.

THE sensory nerve supply of the pelvis is fairly accessible. The sacral plexus and the pelvic plexus of the autonomic system furnishes with sensory nerves the organs with which we have to deal. The blocking of these nerves, therefore, allows the performance of operations upon the whole of the vaginal mucous membrane and the labia, but not upon the clitoris without blocking the nerve supply from above. All except these nerves may be reached by an infiltration block, or by the induction of caudal anesthesia. The uterus and adnexa receive additional sensory innervation from the pelvic splanchnic nerves of the autonomic system.

The interception of the sensory nerve supply to the pelvic organs is simple and comparatively certain in all cases in which adequate exposure of these structures can be obtained. The securing of this exposure anticipates complete abolition of the reflexes of the abdominal wall with resulting negative intraabdominal pressure and the use of gravity to carry the intestines away from the field. In order to successfully block the sensory nerve supply of the pelvic organs after the abdomen has been opened it is obviously necessary to visualize the points at which the blocking is to take place. There are a number of conditions which interfere, in varying degrees, with this visualization. The presence of uterine myomata, or other tumors with abbreviated pedicles may interfere because it is impossible to move them out of the field without causing the patient pain. Acute or subacute inflammatory processes may render peritoneal surfaces so sensitive that a negative intraabdominal pressure cannot be obtained, and the field be obscured by the presence of coils of intestine. Gaseous distension is a common cause of embarrassment, and in some cases even the most perfect blocking of the abdominal wall will not prevent an involuntary expulsive effort on the part of the patient, giving a condition which will be best met by the use of mixed anesthesia.

We have, as a rule, used direct infiltration in anesthetizing the abdominal wall. With the pneumatic injector anesthesia may be established in from two to three minutes, and with almost no margin of error. The solution is, by the infiltration method, brought directly into contact with the ultimate arborizations of the sensory nerves, where it is most efficient, and the edematization of the tissues interferes neither with the performance of the operation nor with healing. Sen-

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sitive cases should have the abdominal wall lifted by means of towel clips in order to avoid pressure upon the viscera while making the incision. While entering the abdomen, muscle spasm should be watched for, as an evidence of incomplete anesthesia, rather than complaint of the patient. Complete abolition of the reflexes should be aimed at, and, as stated, perfect anesthesia will usually show a pelvis free of small intestines when the abdomen is opened. As an additional aid we have made use of pneumoperitoneum, the gas being introduced just before opening the abdomen, and we believe that this will prove to be an aid in emptying the pelvis. In case of marked ptosis, or bony deformity, we have not hesitated to turn the pelvic intestines out upon a rubber towel during the performance of the operation. If this is carefully done, avoiding tension upon the mesentery, and extremes of temperature, it is not a painful procedure. Provision should be made for placing the patient in extreme Trendelenburg, and for tilting the table laterally, without causing the patient discomfort. Provided a preliminary caudal has been made one may not find it necessary to reinforce the anesthesia after opening the abdomen. Where transsacral anesthesia has been employed reinforcement is not necessary. Reinforcement, when necessary, may be made by the use of an anterior splanchnic at the pelvic brim, or by an infiltration block along the lines which the nerves are known to follow, and depending somewhat upon the operative procedure which is to be carried out.

In simple operations, such as suspension, blocking of the round ligaments will suffice. This should be done as follows: Vertical retraction of the abdominal wall exposes the round ligament near its distal end, where it may be steadied while the point of a long needle is inserted into it. In some instances the ligament may be best approached by passing the needle through the abdominal wall. In any case it is to be thoroughly edematized. The same procedure is then carried out on the other side, with the operator making the retraction and the assistant the infiltration. Work upon the ovaries requires an infiltration of the ovarian pedicle. Complicated tubal disease, in many instances, requires transsacral or splanchnic anesthesia, but, with a perfect exposure, sharp dissection and the avoidance of traction it is surprising how much may be done with direct infiltration only. Abdominal hysterectomy may be done under sacral, transsacral, or direct infiltration. The uterine cervix should be surrounded by a subperitoneal infiltration, and the fluid should be used liberally between the cervix and the bladder, and the cervix and the rectum. This has the effect of separating the cervix from these hollow viscera, and simplifies the dissection.

As stated above, the main obstacle to success is inadequate exposure from any cause. Incomplete anesthesia of the abdominal wall, too

vigorous retraction with rigid instruments, marked ptosis, gaseous distension, hypersensitiveness of the intraperitoneal viscera due to acute or chronic inflammatory processes, the presence of large tumors with short pedicles, or even a full bladder may make the completion of the operation under local anesthesia impracticable.

Ovarian cysts of any size may be evacuated by suction, and we have for a number of years operated upon all of our cases under local anesthesia. Dermoids, intraligamentous cysts and subperitoneal fibroids may be handled by the same technic, provided the tumor can be grasped and sharp dissection made. Adhesions, contrary to the general belief, have only occasionally been the cause of failure. Perfect exposure, vertical retraction, and sharp dissection along the white line shows a marked contrast to the orthodox method of introducing the gloved hand and breaking up these bands by the use of the tactile sense alone.

The presence of abscesses and infective processes, while increasing the difficulty of using local anesthesia, serve well to illustrate the advantages of the method, providing operations can be performed under its use. Perfect repose of the viscera, the "silent abdomen," so-called, and the absence of engorgement, is in marked contrast to the condition which is apt to occur when general anesthesia is employed. This quiescence of the viscera not only permits of a more refined technic, but is an important factor in preventing the spread of infection. The rapid excursion of the viscera when a patient is under general anesthesia, the trauma produced by gauze packs, the distortion and displacement of the viscera which must take place during the recovery from general anesthesia, and the retching and vomiting incident thereto, must, in a certain percentage of cases at least, increase the possibilities of disseminating infection with its immediate and remote sequelae, and must, to a certain extent, upset the order in which the viscera were arranged before the abdomen was closed.

Pelvic abscesses which demand vaginal drainage do not lend themselves well to the use of local anesthesia. Many of these patients are in an extremely nervous and septic condition, and unless heavy preliminary hypodermic medication is employed, suffer more or less psychic shock. This is one of the conditions in which psychic incompatibility may be sufficiently marked to contraindicate the use of local anesthesia. Technically, the method also has objections. Nothing less than a transsacral will insure sufficiently complete anesthesia to allow one to drain multiple collections of pus in the pelvis by bluntly rupturing the abscess walls, which is necessary in a certain percentage of cases.

Practically all other gynecological operations which may be performed through the vaginal route are possible under the use of local

anesthesia. The peritoneum may be anesthetized by an infiltration block of the pudic nerves. The uterus may be completely anesthetized, allowing the performance of operations upon the cervix, and endometrium, after an infiltration block of the uterine ligaments through the vaginal vault. The anterior vaginal wall is best anesthetized by a circumferential infiltration. The same is true of the labia and clitoris. Vaginal hysterectomy and interposition operations, as well as vaginal hysteropexy, require sacral, transsacral, or an infiltration block of the peritoneum, and the broad and round ligaments. If only direct infiltration is used it is necessary to eliminate traction as far as possible, and to infiltrate the round ligaments high up as soon as their exposure has been accomplished.

One of the most common causes of complaint in sensitive individuals is due to stretching of the vagina with retractors. It is, in most cases, well to anesthetize the introitus before introducing the retractors, thus insuring more easy dilation of the vaginal canal, and eliminating discomfort from this cause.

We have in many instances, performed vaginal operations upon unmarried women, and occasionally upon young girls, under local anesthesia. Perfect anesthetization of the vaginal canal is especially important, even though only an intrauterine operation is to be performed. The relaxation, resulting from perfect local anesthesia, as evidenced by the easy dilatation of the vaginal canal, is most surprising, and permits one to perform operations upon these classes of cases with much less difficulty than might be anticipated.

The great advantage of the use of local anesthesia is manifest when both vaginal and abdominal operations are required in the same individual. In these cases the patient is inhaling no anesthetic during the period that must elapse between the operations, and before the abdomen is opened, anesthetization of the internal genital organs may be fairly well established from below. Cesarean section under local anesthesia is a comparatively simple procedure, and in a certain percentage of these cases, it is desirable to avoid the use of general anesthesia.

Large or firmly fixed tumors, malignant disease, or marked immobility of the pelvic organs from any cause, are the most difficult conditions with which we meet. Transsacral anesthesia will effectually prepare a patient for any of these operations, so that a reinforcement of the anesthesia will be found unnecessary. However, the technic necessary for the induction of transsacral anesthesia is complicated, it is difficult to acquire and difficult to execute. Patients who are very large or very fat place an additional handicap upon the method, as, in these cases the pelvis is usually deep, and the fat not only increases the distance of the organs from the surface, but, by its

presence, is apt to obscure the view which is so essential when working under local anesthesia. It has been our plan to open the abdomen under local anesthesia, and where complicated pathology is anticipated, to precede this by the induction of sacral anesthesia. The operation is carried as far as practicable, and is completed, when possible, under local anesthesia. Should conditions that in any manner interfere with the carrying out of the procedure in a satisfactory manner present themselves, mixed anesthesia is employed. The rapid, smooth and peaceful manner in which these patients respond to light inhalations of gas or ether, when one's limit has been reached is in such marked contrast to the manner in which people usually submit to inhalation anesthesia, that one might almost feel like using local anesthesia as a preliminary to general anesthesia, in order to facilitate the induction of the latter. This method is so practicable, and its practice enlarges, with such rapidity, the scope of local anesthesia for the individual who employs it, that I feel no hesitation in recommending it. While the merits of mixed anesthesia, as recommended by Crile, are not to be doubted, its superiority over efficient local anesthesia alone is yet to be proved. Whether psychic trauma will be sufficiently reduced as patients develop the faith which will result from the performance of painless operations under local anesthesia, so that surgeons will consider it less of a menace than the inhalation of gas or ether, the future must decide. Surgical results are dependent upon many factors besides those relating to anesthesia alone, and excellent judgment and a highly refined surgical technic must be considered in tabulating results. At any rate, even admitting that mixed anesthesia is the method of choice at present, it must depend largely for its efficiency upon the completeness with which the local anesthesia is employed. Poor local anesthesia demands a greater amount of general anesthesia, and vice versa, and there would seem to be no question but that the method recommended above will much more effectively develop good local anesthesia than would be the case if consciousness is eliminated before local anesthesia is begun. Anoci association may be most effectively employed by the surgeon who has learned to do painless operations under local anesthesia before attempting it.

The use of local anesthesia in the tissues, even in cases in which complete anesthesia cannot be established, so greatly reduces the amount of general anesthesia and mixed anesthesia, as used by Crile and others and furnishes such excellent results, that it would seem desirable to begin at least a certain percentage of gynecologic operations under local anesthesia, or to use local anesthesia combined with a reduced amount of gas or ether, rather than depend entirely upon inhalation anesthesia as a routine procedure. Beginning opera-

tions under local anesthesia, and adding inhalation anesthesia as soon as one's limit is reached in any particular procedure will be found to be the means of developing the technical ability of the operator, and general anesthesia will be found necessary less and less often. On the other hand, should the patient be anesthetized with gas or ether before the local anesthetic is injected the opposite tendency is more likely perhaps to be noted, and one's ability to develop a local anesthesia technic is apt to be somewhat retarded.

In conclusion, I would state that the most ideal condition which has presented itself to us for the performance of surgical operations has been brought about by the preliminary use of morphine, combined with magnesium sulphate, and the establishment of perfect local anesthesia. By this means psychic incompatibility is practically eliminated, although in a large percentage of cases the psychic element has seemed to us to be of minor importance. Mixed anesthesia has many points of advantage. My feeling is that local anesthesia alone, or combined with gas, or with the judicial use of morphine and magnesium sulphate, offers special advantages over other forms of anesthesia now in use.

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(*For discussion, see p.* 431.)

URETERAL OBSTRUCTION*

THE FAILURE TO RECOGNIZE URETERAL OBSTRUCTION A FREQUENT CAUSE OF UNNECESSARY OPERATIONS

BY K. I. SANES, M.D., F.A.C.S., PITTSBURGH, PA.

BEFORE taking up the subject of the paper let me describe briefly the anatomy of the ureter and the etiological factors of ureteral obstruction.

The ureter is an extraperitoneal organ. Its walls are thin and collapsed when empty; but, under pressure, are capable of great dilatation. It is loosely connected with the underlying structures, especially, in its abdominal portion. At the brim of the pelvis the ureter lies directly on bone, while above and below the brim it is in contact with soft structures. It has three constricted areas. The first and most constricted one is at about the ureteropelvic juncture, accentuated by the renal fascia passing over it; the second, the least constricted area, is at the pelvic brim, and the third at the ureterovesical juncture. The nerve supply of the ureter is derived from the renal, mesenteric, spermatic and hypogastric plexuses, which supply the intestinal and the greater part of the genitourinary tracts.

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In its course from the pelvis to the bladder the ureter lies in close contact with organs which not uncommonly are the seat of operable pathology. At its beginning the right ureter is covered by the third portion of the duodenum. The abdominal portions of ureters are situated immediately to the inner side of the colon. At the pelvic brim, on the right, the ureter lies just to the inner side of the base of the appendix, and, not infrequently, is crossed by it; on the left, the ureter is crossed by the first portion of the rectum. The pelvic portion of the ureter in the female, lies posteriorly to the ovary and, on its way to the bladder, passes through the base of the broad ligament to the side and front of the cervix and vagina; in the male, it is crossed by the vas deferens and enters the bladder immediately in front of the seminal vesicle.

ETIOLOGIC FACTORS OF OBSTRUCTION AND THEIR RESULTING PATHOLOGIC CHANGES

Not uncommonly obstructed areas are found along the course of the ureter. They are of different types, and are caused by various etiologic factors. The causes may be extraureteral, including constricting bands, cicatrices, and selerosed cellular tissue, which may either result from operative procedures or follow such inflammatory processes as tubo-ovarian, appendiceal, parametritic, colonic (diverticulitis), etc. Here belong also uterine, broad ligament and ovarian tumors, pregnant uteri, scoliosis, anomalous blood vessels, etc. Obstructing causes may be intraureteral. Such are the impacted calculi, blood clots, and pus plugs, congenital stenosis, strictures from ureteral ulceration, etc. An obstruction may also be the result of such irregularities in the course of the ureter as kinks, angulations, and high insertion into the pelvis.

These various etiologic factors give rise to many pathologic changes in the urinary tract. In a general way, we may say that a normal ureter, obstructed by any of the causes mentioned, becomes dilated above the site of constriction, the degree of dilatation depending upon the length of time and the extent of the obstruction. If the obstruction is bad and lasting, the dilated ureter may become elongated and kinked, the kidney may become hydronephrotic, and, if infection supervenes, there may develop a pyoureterosis and pyonephrosis.

If an obstruction takes place in an inflamed ureter, the character and extent of its pathologic changes will depend greatly on the origin, nature and severity of the preceding inflammation, i.e., whether the inflammation was ascending or descending; extra or intraureteral; tubercular or nontubercular; acute or chronic; ulcerative or nonulcerative. In any case, however, in the inflamed obstructed ureter the destructive changes are much greater and pyoureteronephrosis more

common than in the obstructed ureters without a preceding inflammation.

We see from the above that the ureter lies in close proximity to organs which are frequently the seat of surgical lesions, and that the etiologic factors of ureteral obstruction and the pathologic changes they induce are various and complicated. Before we discuss the causative influence of these facts on our frequent failure to recognize and properly treat ureteral obstruction, I will cite three cases that came under my observation recently.

CASES OF URETERAL OBSTRUCTION MISDIAGNOSED AND UNNECESSARILY OPERATED UPON

CASE 1.—Miss B., age twenty-one, Western Pennsylvania Hospital, No. 1729. History, upon admission Aug. 10, 1920, as follows: For the last five years the patient has been subject to attacks of pain in the right lumbar region, radiating to the front of the abdomen and bladder. No urinary disturbances accompanied the attacks. For these complaints an appendectomy was performed three and one-half years ago. As the attacks recurred, she was operated upon eight months later, the stump of the appendix was removed and an operation for a Lane's kink was done. No relief followed the second operation, and a year later the patient was subjected to a third operation; this time for obstructing adhesions. As this also failed to give relief, a fourth operation for adhesions was performed a year ago. The data obtained from the history suggested an investigation of the urinary tract. Repeated explorations of the right ureter showed an obstruction four cm. above the right ureteral meatus, which was finally passed. The urine obtained from the right kidney showed a few leucocytes; otherwise it was normal. A pyeloureterogram was taken, which demonstrated a dilatation of the ureter above the site of obstruction. A diagnosis of stricture of the ureter was made.

CASE 2.—Mrs. B., age 25, Western Pennsylvania Hospital. No. 4694. She was admitted to the hospital Dec. 4, 1919, with the following history. For nine years she has been suffering from a constant dull pain in the right lumbar region, with frequent acute exacerbations requiring morphine. The pains when severe, radiated to the right iliac fossa and down the thigh. She had frequency, nocturia, and, at times, hematuria. For this, six years ago, an appendectomy and a right salpingooophorectomy were performed. No improvement followed. An x-ray examination three years ago showed a right-sided renal shadow, and an operation for nephrolithiasis was undertaken. No stone, however, was found, but a renal cyst was incised. Her condition remained unchanged except for the added chills and fever. Upon admission the urine showed pus; but the cystoscope revealed no pathology in the bladder. Repeated catheterization of the right ureter demonstrated an obstruction about 10 cm. above the ureteral ostium, which was finally passed. The specimen of urine obtained from the ureter was loaded with pus. A ureteropyelogram showed a dilated, kinked ureter with a large renal pelvis and obliterated major and minor calices. A diagnosis of a right ureteral kink with a pyonephrosis was made.

CASE 3.—Mrs. S., age 28, Western Pennsylvania Hospital, No. 7603. After the delivery of her first child, six years ago, patient developed a backache, worse on the right side. During her next pregnancy, four years later, the backache somewhat improved, but after the delivery the symptoms became worse than ever. As the complaint was attributed to a lacerated perineum and cervix, a perineorrhaphy

and trachelorrhaphy were performed two and one-half years ago. The pain, however, grew gradually worse. Six months later, in addition to the backache, she developed a pain in the left groin which annoyed her so much that she consented to a second operation. The uterus was fixed and the appendix was removed. No relief followed; in fact, her symptoms became worse. Chills and fever began to accompany the attacks of right lumbar pain.

She was admitted to the hospital May 1, 1917. Her urine was found to contain many red and white blood cells. Upon catheterization of her right ureter, its upper third was found blocked. Repeated attempts to pass the obstruction failed. A specimen of urine from the right kidney showed pus. An x-ray plate of the right urinary tract demonstrated a stone at the tip of the catheter and a ureteropyelogram showed the ureter dilated below the obstruction. No opaque fluid was found above the stone. A right ureteronephrectomy, May 28, 1917, confirmed the diagnosis of an obstructing ureteral calculus with pyonephrosis.

CAUSES OF DIAGNOSTIC ERRORS IN URETERAL OBSTRUCTION

The anatomic relations of the ureter and the complicated pathology of the obstructed ureter, described above, explain, to a great extent, our frequent failures to recognize and interpret disturbances of ureteral origin. Not infrequently symptoms, that are due exclusively to lesions in the ureter, are ascribed to that of the adjoining organs; and, when pathology in the ureter and its adjacent organs coexists, the symptoms resulting from such combined pathology are attributed entirely to the neighboring organs, and the ureter is ignored in the diagnostic consideration. Sometimes, even after the surgical removal of adjacent organs, the ureteral disturbances that persist after the operation are attributed to postoperative adhesions for which surgical procedures are recommended and carried out.

Of all the abdominal organs, the appendix, in our observation, is most commonly involved in such diagnostic errors. As we mentioned above, the ureter, at its second constricted area, is situated immediately to the inner side of the appendix, and, in some cases is crossed by it. One can easily see how, for instance, an acute right-sided ureteral pain from an impaction of a calculus in this constricted area may be interpreted as an appendiceal pain; how a ureteral inflammation, resulting from extention of an appendiceal inflammatory process, may be overlooked, and how the symptoms of ureteritis or ureteral strictures secondary to an appendectomy may be ascribed to postoperative abdominal adhesions.

The pelvic organs in the female are next in frequency involved in such diagnostic errors. The intimate relation of the ureter to the pelvic organs and the not uncommon exacerbation of ureteral disturbances during menstrual periods lead us, when not sufficiently on guard, to interpret ureteral obstructive symptoms as those produced by the pelvic organs, to ignore them when they are secondary to pelvic pathology, and to ascribe them in postoperative cases to pelvic adhesions. For similar reasons disturbances caused by ureteral obstruc-

tion are incorrectly attributed to pathology of the rectum, colon, ileum, seminal vesicles, etc.

INDICATIONS FOR INVESTIGATION OF THE URINARY TRACT IN CAREFULLY TAKEN HISTORIES

Cases of ureteral obstruction always give in their clinical histories, if carefully taken, data indicating pathology in the urinary tract. With the great varieties of location, etiological factors, structure, and complications of ureteral obstruction, one cannot expect to obtain symptoms sufficiently characteristic, as to make a definite diagnosis; but a good history almost always gives data that suggest the investigation of the urinary tract, which usually lead to such diagnosis. These data include:

1. Continuous ache or pain localized at some definite part of the urinary tract, the order of frequency of such locations being the kidney, bladder, and ureter.

2. Intermittent attacks of severe pain in lumbar or ureteral region with radiations, usually, downward toward the bladder and thigh, and, occasionally, upward toward the kidney, such attacks being frequently accompanied by gastric disturbances, chills and fever.

3. Urinary disturbances such as frequency, dysuria, and urgency (amounting at times to incontinence), which may be continuous or occur only during the intermittent acute attacks, the most common of these disturbances being frequency of urination.

With such a history a urinalysis (in females, of a catheterized specimen) should be made; but while the presence of pus or blood in the urine, especially if it is known to be intermittent, is of unquestionable diagnostic value, negative findings can by no means exclude ureteral pathology.

If the data obtained so far suggest an investigation of the urinary tract, a physical examination of the kidney and ureter should be made first. By first percussion over the lumbar region and by bimanual pressure over the lumbar and hypochondriac regions we look for renal tenderness. At the ureteropelvic junction and at the brim of the pelvis by pressure and palpation, we try to make out the tender, dilated ureter if such be present. By vaginal we can examine the lower third of the ureter. This last examination is of particular importance, for by it the terminal three inches of a pathological ureter can be felt as a cord-like, tender tube along the anterior and lateral fornices of the vagina as it runs backward, upward, and outward to the pelvic wall. As a part of the physical investigation an examination of the pelvic organs and the appendix should be made on account of their anatomic relationship to the ureter and the influence of their pathology on ureteral obstruction.

METHODS OF INVESTIGATION OF URETERAL OBSTRUCTION AND THEIR RELATIVE IMPORTANCE

The patient is cystoscoped and a careful inspection of the ureteral orifices is made. We may find the cause of the obstruction right at the ureteral meatus, may see a stone presenting at the orifice, or an edematous and inflamed meatus, suggestive of a calculus, immediately above it. We may notice a stenosed, prolapsed, dilated, or ulcerated ostium; we may find the meatus obstructed by a papillomatous growth or, in bad cystocele cases, by extensive folds of the mucous membrane.

After careful cystoscopic inspection of the orifice, an opaque graduated catheter is introduced as far as possible into the suspected ureter, preceded, if required, by ureteral meatotomy for stenosis. A specimen of the kidney urine is then obtained for culture, chemical and microscopic analysis, and, if tuberculosis is suspected, guinea pig inoculation.

Whether the catheter is passed up into the kidney or, on repeated attempts, is stopped at a definite point below it, the question of absence or presence of obstruction is not definitely settled. Such obstructing factors as calculi, angulations, or constrictions from external pressure, may be present; and yet the catheter may pass up into the kidney. Even bad cicatricial strictures resulting from ulcerations may, at periods of greater patency, permit the passage of a catheter. On the other hand, in the absence of obstruction in the ureter, the catheter may be prevented from going up into the kidney if caught in a small diverticulum, valve, or in the wall of a somewhat dilated and freely movable ureter. In certain conditions, however, the catheter does give us very suggestive information, A "hang" during the withdrawal of a catheter speaks in favor of a stricture; a rapid collection through the catheter, with the aid of a syringe, of more than 15-20 c.c. of urine, suggests a hydro- or pyonephrosis; and the finding of scratch marks on a waxed tipped catheter used for ureteral examination diagnoses a calculus. If an x-ray picture is taken with the catheter in position, the catheter shadow may also demonstrate the location and size of the stone.

The most valuable aid, however, in the diagnosis of ureteral obstruction is given by ureteropyelograms. The opaque fluid injected into the ureter and renal pelvis gives us x-ray shadows which, if properly interpreted, supply us with valuable information that cannot be obtained by any other means. It shows such cases of ureteral obstruction as kinks, strictures, etc.; it demonstrates constrictions resulting from extraureteral pathology; it discovers such diagnostically difficult conditions as obstruction by an anomalous renal vessel; it distinguishes the simple inflammatory stricture from tubercular and both from noninflammatory obstruction; it proves definitely the pres-

ence of the obstruction by demonstrating the dilatation of the ureter and pelvis above it; it gives quite a definite idea about the extent of pathologic changes, and, not infrequently, about the prognosis and treatment of ureteral obstruction. True, ureteropyelography entails some technical difficulties and, if not carefully done, is liable to cause pain and injury to the patient; but this applies just as well to many other diagnostic and therapeutic procedures. In our judgment a great deal of these difficulties may be avoided if we use smaller catheters, inject smaller quantities of opaque fluid, and drain away the fluid through the catheter after taking the ureteropyelograms. This has been our experience in several thousand pyelograms.

I have called attention in this paper to the frequent failures to diagnose ureteral obstruction, gave as reasons for them the anatomic relationships of the ureter and the great variety of obstructive factors; I brought out the point that good histories and careful physical examinations could be relied upon to give us the indications for investigation of the urinary tract; and, finally, discussed the diagnostic value of cystoscopy, ureteral catheterization, and ureteropyelograms in the cases of ureteral obstruction.

If the studies suggested above were conducted in doubtful urological cases, many a patient could have been saved the trouble of unnecessary treatment or operative procedures, and could have their pathologic lesion corrected before it became irreparable. The unfortunate results of the neglect of such investigations are seen in almost every clinic. Attention of the profession, especially the surgical, should be called to it. True, such investigations require a great deal of effort. It demands a carefully taken history, a complete urinalysis, an examination of the abdominal and pelvic organs, a cystoscopic examination, a catheterization of one or both kidneys, an x-ray study of the urinary tract; and, not infrequently, of such abdominal organs as gall bladder, colon, stomach and duodenum. Such a study is time consuming, expensive, and requires a close cooperation of well organized cystoscopic, pathological and roentgenologic departments. All this is true, but let us not use such arguments against diagnostic methods of procedure that are intended to save many lives and much unnecessary suffering.

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THE INDICATIONS FOR AND THE DANGERS IN THE USE OF SPINAL ANESTHESIA IN OBSTETRICS, GYNECOLOGY AND ABDOMINAL SURGERY*

By R. R. Huggins, M.D., F.A.C.S., Pittsburgh, Pa.

TWENTY-TWO years ago Bier, of Kiel, developed the technic of spinal anesthesia and demonstrated its value as an aid in surgical procedures upon the lower extremities. It was at once popularized by Tuffier who extended its application to operations upon the pelvic and abdominal organs. During this time it has been used with various degrees of satisfaction by surgeons all over the world. Some are enthusiastic about it, others denounce it in no uncertain terms. A study of the literature shows that the indications and contraindications are not clearly understood. Even those who are most enthusiastic have not made clear exactly why it is to be preferred to other methods of anesthesia under certain circumstances; nor has an earnest effort been made to educate the profession as to its advantages or dangers. That its use has slowly grown more popular and that those who have taken the trouble to develop a reliable technic and who have a healthy respect for its dangers still continue to use it, would suggest that it has earned a permanent place among anesthesia procedures.

When a new therapeutic or a new surgical procedure is discovered we are very prone to expect the unusual and sometimes the impossible. For this reason they are used as a last resort after all other means have been employed with failure or given without knowledge either of their true indication or physiologic action. If one attempts the use of spinal anesthesia only when some other anesthetic is contraindicated, unless he has had a good experience with it, he may be greatly disappointed and the experiment may be accompanied by disastrous results. We believe that no anesthetic has yet been discovered that is free from mortality either immediate or remote. A certain number of deaths occur suddenly on the table from all forms of inhalation anesthesia, whether it be ether or nitrous oxide. The percentage of deaths depends upon the skill of both the anesthetist and the operator. That there is a mortality and morbidity with which all forms of inhalation anesthesia have much to do, which occurs after the patient leaves the operating room is equally true. There is an interval here that still needs much study and careful observation in order to deter-

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mine how the credit must be shared between the shock and exhaustion incident to the anesthetic and that due to the surgical procedure minus the event of anesthesia, in patients who die from so-called exhaustion and shock within two or three days after an operation. Here lies one of the main points in the indication for spinal anesthesia in selected cases, and in a comparison of the dangers of its use this must not be overlooked. That death does not occur for forty-eight hours after operation in no way absolves a certain responsibility for any form of inhalation anesthesia.

The stimulating action of ether in the first half hour of anesthesia is readily observed in the flushed face, the rapid respirations, the increased pulse rate and the hot, moist skin. In patients who take the anesthetic badly, there is in addition, the suffused cyanotic skin of the face, the engorged veins, the stiff muscles and the forced respirations due to increased mucus, laryngeal spasm or obstruction as a result of falling back of the tongue, so that ether anesthesia produces a condition of activation and stimulation at first, which is followed later by the exhaustion which is certain to follow long continued overactivity. The later stages of prolonged anesthesia are characterized by lowered temperature, absence of the flushed skin of the early stages, skin drenched with perspiration, respirations that are shallow, and evidence of exhaustion. Many patients are not sufficiently supplied with a reserve force of energy to withstand an hour or two of such activation without exhaustion. Add to these effects of the anesthetic *per se*, the increased trauma on the part of the surgeon in overcoming the tense abdominal muscles, the tendency of the patient's respiratory movements to extrude the intestines through the incision, the increased amount of hemorrhage as a result of the stimulation, the overventilation of the lungs due to rapid breathing, the loss of fluid from sweating and postoperative vomiting, and we have the elements that contribute to shock. It is readily apparent that the increased heart action incident to the stimulation and rapid breathing during the stage of excitement leads to cardiac exhaustion and in a patient with a weak cardiac muscle the result is the same as it would be under forced exercise.

In spinal anesthesia, the blood pressure falls, the respirations become slow, the pulse rate is reduced, the heart is working slowly as a result of the lowered blood pressure against less peripheral resistance and the skin remains dry and warm. In no possible way could the heart be given a better rest for a certain definite period. If the patient has been properly prepared by the previous administration of scopolamine and morphine, she comes to the operating room indifferent and oblivious to her surroundings. There is no psychic trauma and consequently no expenditure of nervous energy. A patient with the

combined "Daemmerschlaf" and spinal anesthesia presents the appearance of one in hypnotic sleep, so that after an operation of one and one-half hours with all bodily activities subnormal and all traumatic impulses blocked, the patient has expended less energy than under normal conditions. In addition, there is perfect relaxation of the abdominal muscles and the contracted intestines lie quietly in the abdominal cavity. As a result of the low blood pressure, bleeding and troublesome oozing is much less. The conservation of energy that may be applied and which is often needed in the stress of postoperative recovery, the good condition of the patients after extensive severe operations, the lessened postoperative shock and discomfort with rapid recovery of strength, are all factors that lead to enthusiasm in the interested observer. It is by such a method that shock is reduced to the minimum and in our experience it has not only resulted in a lower mortality in certain cases, but it has led to a more rapid recovery with lower morbidity.

With the above important facts in evidence, certain groups of cases are at once suggested where spinal anesthesia is especially indicated. They include severe pelvic infections with dense adhesions, where the removal of the diseased structures is accompanied by profuse bleeding and an unusual degree of shock, and in fibroid tumors where the heart and entire musculature is weakened as a result of toxemia and hemorrhage. A similar condition is found in chronic gall bladder infections. In such patients there is usually a weakened heart muscle and often the general condition is much below par as a result of the infection and associated toxemia. In obesity accompanied by fatty degeneration of the heart muscle and where operation is often followed by pneumonia; in the early stages of an acute spreading peritonitis before the patient becomes saturated with the toxins of infection; the mortality of such a series of cases is still sufficiently high in every clinic to cause concern, and it is here that we have derived the greatest benefit from spinal anesthesia. That we have been able to operate safely many cases which die under the use of ether, leads to our enthusiasm and earnest effort to bring out if possible the advantages and dangers of this method, and lend what aid we can in placing it upon a safe and sound basis. It is in the above class of patients, the majority of whom are young or in middle life that should be operated without mortality. The heart muscle temporarily weakened from infection will entirely recover its normal if the cause is removed. It is definitely indicated in pulmonary tuberculosis and asthma.

It is dangerous where there are permanent changes in the arterial system which interfere with the normal elasticity of the vessels. It has been repeatedly stated that it is contraindicated after the age of sixty-five. It is dangerous here because of the drop in blood pressure

in arteries which do not have the power to adapt themselves to the changed condition on account of their inelasticity. It is not a matter of age. This may happen in one much younger if there is marked disturbance of the arterial tone, and on the other hand it can be given to a person much over sixty-five if the walls of the arteries are healthy. For this reason we avoid its use in patients with a high blood pressure, and where there are signs of the above mentioned arterial changes. For this same reason we avoid its use in patients who have an extremely low blood pressure. A blood pressure of eighty-five or ninety usually indicates a low vital resistance and it may be uncertain how much fall in blood pressure the patient may safely withstand. We must constantly bear in mind that surgery is contraindicated in some patients on account of the low vital resistance and that no form of anesthesia can be given without risk. We believe that a careful study of the arterial system together with a knowledge of the vital resistance is an important element in the successful use of spinal anesthesia because it is here the danger lies rather than in a sudden effect upon the respiratory center. With our present method, there seems little danger from this standpoint. We have avoided its use in patients desperately sick such as in general peritonitis and those in severe shock. The experience of those who used it during the late war would indicate that results were better in a comparative way than in other forms of anesthesia. Patients who are psychopathic or extremely nervous should not be given spinal anesthesia. Where there is a history of chronic headache its use is contraindicated for the reason that the patient may get the idea that this symptom has been aggravated. In syphilis especially when it in any way involves the nervous system spinal anesthesia should not be used because all symptoms which follow the operation are usually attributed to the operation and no doubt, in cases where paralysis of various forms have been reported following this method of anesthesia, careful study would have revealed syphilis as a cause instead of the anesthetic. We have made every effort to prevent accidents because we believe no unnecessary prejudice should be established against a method of such great value if given properly and with due regard for its dangers.

Spinal anesthesia is not free from danger, neither is any other anesthetic, even the simplest if not given with intelligence. It requires the greatest care always with attention to detail which includes careful study of the patient before its administration and constant attention by some one who is trained to observe the patient throughout the period of anesthesia. Unless, one is willing to subscribe to all these details, after having acquired a working knowledge of the method he should never be responsible for its administration. We have used it with the above principles in mind over a period of years. We believe that it is a special method which will eventually become part

of our armamentarium and will be used under special indications. It is folly to use it generally or to expect it to succeed when there are certain definite contraindications to its use or as a last resort. Surely we have reached the place where it is well known that we have no anesthetic which can be applied indiscriminately and that will meet all requirements. Many charts might be exhibited showing the marked difference in the reaction of the pulse and temperature following this method as compared with inhalation anesthesia. This would consume time and fill valuable space and after all would in no way convince any one who may be skeptical. This is all strikingly demonstrated at the bedside. In our last 1000 major gynecological operations exclusive of five deaths of peritonitis which were caused by imperfect sterilization, in one instance contaminated water, in another improperly prepared gloves, our mortality has been seven-tenths of one per cent. This included many bad risks, some of whom could not possibly have been operated safely by any other method. We are pleased with the result and feel that our mortality has been distinctly lowered.

We have had two fatalities in a series of 1500 cases. The first occurred in a case of eclampsia in a primipara with contracted pelvis where cesarean section was necessary. The patient had several convulsions before the operation and was seized with a convulsion almost immediately after the anesthetic was introduced. Death occurred suddenly from cessation of respiration in spite of all efforts of resuscitation. While the condition of the patient was not good and there may be a possibility that she died from the convulsion, I have no doubt that the death was due to the sudden change in the spinal fluid which carried the anesthetic immediately up the canal to the medulla. Little is known about the spinal fluid at best, but that it is greatly disturbed in the paroxysm of a severe eclamptic convulsion is undoubtedly true. I would say that spinal anesthesia is definitely contraindicated in the presence of any form of convulsions. The second case was a patient who had been ill for ten weeks with a severe puerperal infection, where operation was undertaken as a last resort and where one would be almost certain of death with any method of procedure. She had a blood pressure of only 80 before blood transfusion which brought it up to 90. It may be recorded as a foolhardy attempt at the impossible. It was interesting from the standpoint of emphasizing the danger where there is low vital resistance with extremely low blood pressure. Before giving the anesthetic, we had placed a cannula in the vein and had given a solution of adrenalin almost immediately. As soon as anesthesia came on, the blood pressure fell and continued to fall without any response to all stimulation. It was a striking example of death from fall in blood pressure in a patient who had no reserve force in the vessel walls upon which to draw in such an emergency.

These deaths in no way change our views about spinal anesthesia. It should never have been given to either of these patients. We learn from mistakes and they should be recorded. It is the only way progress may be attained, but these deaths should not be charged against the method without reference to the condition of the patient at the time of operation. We are entirely satisfied that we have been able to operate upon patients successfully where it would have been impossible under any other form of known anesthesia today, and that our mortality has been materially lowered in the class of cases above mentioned among the indications for its use. We are so thoroughly convinced of this fact that we desire to throw every safeguard about it and offer our experience in such a way that those who may be interested may approach it in a sane manner and without prejudice.

We have always used novocaine because it is the least toxic of all effective local anesthetics. We give 2 c.c. of an 8 to 10 per cent solution in water which has been trebly distilled. To this is added 4 minims of absolute alcohol. The solution is made fresh and boiled just before its introduction. All instruments used are also boiled in distilled water so that all danger of chemical irritation is avoided. We believe it is of the greatest importance to be sure about the technic and all details in order to avoid the danger of infection. If this practice is carefully followed, headaches will seldom occur. This is a sequel often mentioned and given as a criticism of the method. Wherever headaches have occurred, it has been due to some error in technic. At one time a number of headaches in a series of cases caused us to make a thorough examination which revealed the fact that we were using distilled water which was contaminated with some inorganic matter from a defective still. Since that time, we have used a small glass still and this water is always freshly distilled just before use. Some dissolve the novocaine in the spinal fluid. We have hesitated on account of the danger of infection from imperfectly sterilized novocaine. No other untoward symptoms such as local paralysis have been observed. We aim in every way to avoid psychic shock and all mental excitement or disturbance by careful preparation of the patient for anesthesia. Two hours before operation, a hypodermic of scopolamine gr. $\frac{1}{200}$ and morphia gr. $\frac{1}{8}$ is given. Thirty minutes before the scheduled time a second hypodermic of morphia gr. $\frac{1}{8}$ is administered. The patient is then brought to the operating room in a comfortable sleepy condition which renders even the most nervous individual free from fear and excitement. Ears are plugged with cotton and the eyes blind-folded and all unnecessary talk and noise forbidden in the operating room. With the additional fall in blood pressure, the patient often goes to sleep and does not regain interest in her surroundings until the operation is ended. All "grand-stand" performance such as allowing patients to witness the proceed-

ings, reading, smoking, etc., are not allowed. Before they are sent back to the ward another hypodermic of morphia is given to control the pain, the onset of which is somewhat sudden and may be severe after the effect of the anesthetic passes away. We never place our patients in the Trendelenburg position because we believe it increases the danger. We do not as yet know exactly what may happen in the spinal fluid under all circumstances and I have seen trouble in the hands of other men which I thought was caused by the extreme Trendelenburg position.

CONCLUSIONS

Increased experience leads us to the same conclusions stated in a paper before this Society five years ago. The freedom from nausea, abdominal distention, postoperative weakness and other disturbances so common with other forms of anesthesia recommend it as an improved method for cases when given under proper supervision and with full knowledge of its danger. We believe this method to be worthy of careful consideration on the part of every progressive surgeon who is willing to spend the time and care which are necessary in order to achieve success. Spinal anesthesia is the best anesthetic known today for certain operations in the lower abdomen. It should be given only after careful study of the patient. If it is not properly employed by one possessing sufficient skill, it may have a large mortality. There is no form of anesthesia which is altogether free from danger either immediate or remote. There are well defined contraindications to the use of all anesthetics in certain instances, and the operator must exercise considerable judgment as to which anesthetic should be employed in a given case.

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(*For discussion, see p.* 433.)

OXYGEN IN THE PERITONEAL CAVITY, WITH REPORT OF CASES*

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IF IT seems necessary to offer an explanation of a paper on the intra-abdominal use of oxygen, at this time, may I say that my attention was recently redirected to the subject by a number of physicians who spoke of this method of using the gas as new in surgery. Besides a reawakened interest in the subject, because of the clearer concept resulting from the use of oxygen in war surgery, there is an added interest in the comparatively new use of oxygen in connection with radiography.

Doctors Stewart and Stein, in a recent number of the *Journal of Roentgenology*, describe the methods and results of introducing oxygen in the abdominal cavity "to make visible a number of organs, tumors and abdominal areas which heretofore have been more or less inaccessible to the Roentgen ray examination. The liver, spleen, and region of the gall bladder, pyloric end of the stomach, the wall of the stomach and large intestine with gas contents and the bladder filled with urine can all be distinctly outlined by gas inflation." The authors state "that the oxygen method is not a competitor of the opaque meal method, as the latter concerns the hollow organs, while oxygen inflation of the peritoneal cavity shows the solid structures but, in conjunction, the two methods are ideal and, when the oxygen method has been perfected to a greater degree, the gas inflation for an obscure condition may save many patients exploratory laparotomies."

During the years 1908, 1909, and 1913, I published three articles on the intraabdominal use of oxygen. The first paper was written with the purpose of stimulating interest in the subject, reviewing the literature, reporting illustrative cases and mapping out fields for further investigation. In this paper were reported experiments made upon animals with the purpose of discovering the beneficial effects, as well as the possible dangers, of the introduction of oxygen in the abdominal cavity. The tests were conducted to determine the absorbability of oxygen when injected into the abdominal cavity; the effect upon blood pressure, pulse, respiration, degree of anesthesia and the time of recovery after the anesthetic was discontinued; to determine the danger point of intraabdominal pressure, as expressed by a fall in blood

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pressure, respiratory difficulty and cardiac failure and the effect of oxygen upon the formation of adhesions. Although I reported many of these experiments upon animals in my earlier paper, a brief résumé of the purpose and results of the experiments, in which I was assisted by Dr. Harold D. Meeker and Dr. James T. Gwathmey, may prove of interest at this time.

In the experiments to determine the absorbability of oxygen, when injected into the abdomen of a cat, the following technic was employed: a cat was anesthetized, the abdomen shaved, and a small incision made down to the peritoneum. A small trocar was introduced through this tissue at a sharp angle, while the peritoneum was lifted away from the intestines. The trocar was secured by a purse string suture of silk. The arrangement of the apparatus made it possible to determine the amount, the temperature and pressure of the oxygen used. The gas was introduced at a temperature of 38° C. A number of animals were distended with 200 c.c. of oxygen at 60 mm. water pressure, others with 300 c.c. at 100 mm. pressure and still others with 400 c.c. at 200 mm. pressure. After withdrawal of the trocar and closure of the wound, the cat was partly immersed in a jar of water to determine possible leakage. The animals were observed at frequent intervals and apparent reduction in the size of the abdomen noted. When the abdominal girth approximated the normal, the cat was again anesthetized, the abdomen punctured under water, and any gas bubbles expressed were collected and measured. Summary: the oxygen was completely absorbed in all cases left undisturbed thirty-six hours. In six of the cases no trace of the gas could be found after twenty-four hours, and in two none after eighteen hours. The increased intraabdominal pressure had but little influence in hastening the process of absorption.

In the second series of experiments the effect of the intraabdominal introduction of oxygen was noted upon the following: (1) blood pressure, (2) pulse, (3) respiration, (4) degree of anesthesia, (5) time of recovery after the anesthetic was discontinued.

A cat was anesthetized, a carotid artery exposed, and connected in the usual manner with a mercurial manometer and kymograph. The oxygen was introduced into the abdomen in the manner described above. The following observations were made: (1) a slight increase in pulse rate. This was probably due to a certain amount of oxygen reaching the heart and stimulating the process which causes contraction of the heart muscle. (2) A slight increase in respiration, probably due to a stimulation of the respiratory center, dependent upon an increased production of carbon dioxid. (3) A slight rise in blood pressure, which returned to normal in two or three minutes. The rise was due to pressure on the splanchnic vessels, thus assisting the venous flow to the right heart, and obstructing the arterial flow. The return to

normal was probably due to a compensatory dilatation of other vessels and to diminished diaphragmatic excursions which would cause a lessened amount of blood to flow from right to left heart through less distended lung tissue. (4) In all cases the immediate effect upon the degree of anesthesia was marked, the animal showing a tendency to come out from under the anesthetic almost immediately. In cases where the anesthesia was profound, reflexes quickly became active. (5) Animals into which oxygen had been introduced were able to stand in two to ten minutes after discontinuance of the anesthetic.

In the third series of experiments a number of cats were distended with air, the same technic, quantity and pressure of gas being used as in the oxygen experiments, the object being to effect a comparison with the second series of experiments with regard to the points in question. The effect on the pulse and respiratory rate was less marked, the blood pressure showed essentially the same result as in the second series. The influence of the introduction of air upon the degree of anesthesia was practically nil. The time of recovery from the anesthetic after it was discontinued was from fifteen to twenty-five minutes.

In the fourth series of experiments a number of animals were distended with oxygen under high pressure in order to determine the danger point of intraabdominal pressure, as manifested by a full blood pressure, respiratory embarrassment and cardiac failure. The gas was introduced in the same manner as in the previous experiments, but the pressure measured by a mercurial manometer. The pressure was raised to the equivalent of 1,500 to 1,800 mm. of water, and in all cases the abdomen was exceedingly tense, so that it was scarcely possible to make any indentation with the finger tip. It was observed that the blood pressure rose steadily until the intraabdominal pressure reached a point varying between 1,500 and 1,800 mm. of water, when it suddenly dropped. The heart action became more rapid and less regular and respiratory embarrassment primarily, and cardiac failure, secondly, caused death in a short time. Autopsy revealed no microscopic damage to the viscera. The effect on the animal of the high intraabdominal pressure demonstrated that the danger from the mechanical pressure of the gas may be practically disregarded. There was but slight rise in blood pressure, and no marked respiratory or cardiac disturbance until the pressure became extreme, i.e., reached a degree far in excess of that to which any human abdomen would likely be subjected either by accident or intention. In any case the respiratory embarrassment would give warning of the approach of a danger point.

In the fifth series of experiments the object was to determine the effect of the intraabdominal introduction of oxygen upon the formation of adhesions. Abdominal section was performed in a number of

cats. In some the parietal and visceral peritoneum was scarified, the abdomen moderately distended with 200 to 300 c.c. of oxygen, according to the size of the animal, and the wound closed. In others the same operative procedure was performed but no oxygen introduced into the abdomen. In still other animals, in order to make the approximation of the scarified surfaces a certainty, a portion of small intestine three inches long was anchored to the transverse colon by two silk sutures. The approximated surfaces between the sutures were generously scarified, the abdominal cavity distended with oxygen, and the wound closed. This procedure was repeated on other animals and the wound closed without the introduction of oxygen. The animals used in this series were left for two and four days respectively. The contrast observed on autopsy between the cats in which oxygen had been used and those in which no gas had been injected was striking. Of the six treated with oxygen, two had a few cobweb adhesions close to the anchoring sutures, one had a few fine adhesions between approximated intestines; all other cases were free from adhesions of any sort. In every instance, however, where oxygen was not employed, abundant adhesions were found, both intervisceral and parieto-visceral. The difference between the adhesions found on the animals autopsied on the second and those autopsied on the fourth day was one of density rather than number.

The deductions would seem to be: (1) that the oxygen mechanically held the scarified surfaces apart until new cells were formed; (2) that the oxygen increased the activity of the individual cells, thus hastening a new growth of epithelium to replace the destroyed peritoneal cells, the denuded areas being thus covered over; (3) that the increased peristalsis caused by the oxygen was unfavorable to the production of adhesions.

In addition to the observations already recorded, a striking change in the color of the blood was noticed upon the introduction of oxygen into the abdominal cavity of cats intentionally put into a state of partial asphyxia. The dark blood quickly changed to scarlet. It was also observed that intestinal peristalsis was increased by the atmosphere of oxygen. In no case was there microscopic evidence that oxygen was an irritant to the peritoneum or any of the abdominal viscera.

From the above experiments one may deduct the following: (1) Oxygen is completely absorbed in the abdominal cavity. (2) It is a slight respiratory stimulant. (3) It is a slight cardiac stimulant. (4) It has but little effect upon blood pressure when the pressure of the gas is moderate. (5) It tends to bring an animal quickly from deep anesthesia. (6) It hastens the recovery of an animal after discontinuance of the anesthesia. (7) A pressure of more than 1,500 mm. of water may cause collapse. (8) Oxygen tends to prevent the formation of

adhesions. (9) It quickly changes a dark blood to scarlet in cases of anoxemia. (10) It stimulates the intestinal peristalsis. (11) It is not an irritant to the peritoneum or the abdominal viscera.

After many months of experimentation upon animals, I introduced oxygen into the peritoneal cavity, following laparotomies on patients. So far as I was able to learn at the time of publishing my earlier papers on oxygen, the gas had not been introduced and allowed to remain *in situ* until absorbed, previous to my own experiments in this line, though Thiriar and others had employed the gas in a continuous stream for flushing out the abdominal cavity after laparotomies and after evacuations of ascitic fluid in tuberculous peritonitis.

In more than two hundred and fifty laparotomies, I have used oxygen in the peritoneal cavity with uniformly favorable results. The method has been to balloon the abdomen with pure gas (94.3-97 per cent oxygen) at a temperature of from 90-100 degrees F., close the wound and allow the tissues to absorb the oxygen. In conditions of abdominal distention with ascitic fluid, in certain forms of tuberculous peritonitis, and in some cases where large tumors were removed, the gas was introduced to the point of distention caused by the fluid or tumor.

The following cases are reported to illustrate the action of oxygen in the abdominal cavity.

1. C. V., age thirty-nine, married. This patient consulted me January 12, 1904. She was anemic, had intestinal indigestion, prolapsed and cystic ovaries and chronic appendicitis. May 20, 1904, the right ovary, tube and appendix were removed. Many tuberculous nodules were found, especially on the broad ligament and left ovary. Immediately following the abdominal introduction of oxygen, the blood became of brighter color, and the pulse and respiration distinctly improved. The oxygen was absorbed in thirty-six hours. The pathological report was: "Follicular ovarian cyst; acute miliary tuberculosis of the peritoneum covering the ovary and appendix." September, 1921, the patient was reported well and strong and with no evidence of tuberculosis.

2. B. L., age thirty, single. Admitted to the hospital suffering from diffuse tuberculous peritonitis, cystic ovaries and chronic appendicitis. Operation was performed April 20, 1906, and included curettage, removal of the appendix, right ovary and portions of the left ovary. There was considerable cyanosis present, which disappeared upon the introduction of oxygen into the peritoneal cavity. The pulse immediately became stronger, respiration deeper and the patient's condition greatly improved. In forty-eight hours there was no evidence of the presence of the oxygen. The intraabdominal administration of the gas unquestionably had a distinct tonic effect in this case. A letter from the patient, June, 1921, states that there has been no return of the tuberculous condition.

3. J. H., age twelve, male. This patient was operated on April 8, 1919. The boy was greatly emaciated. Marked tuberculous peritonitis and considerable fluid were found in the abdominal cavity. The small intestines were matted together with adhesions and were separated with great difficulty. When the adhesions were freed, the intestine for more than four feet was denuded of all peritoneum—leaving a raw, bleeding surface. The appendix was removed and the abdomen dis-

tended with oxygen and closed. September 12, 1921 the mother of the boy reports that the lad weighs 140 pounds, gain of thirty-five pounds, and is absolutely well.

4. W. E., age sixty-eight, female. I was called in consultation, April 14, 1908, for patient suffering with abdominal carcinosis and kinking of the intestine, with obstruction. The case was so extreme that operative procedure was warrantable only upon the ground of attempting to control the vomiting which was persistent and almost fecal in character. A large amount of fluid was removed from the abdomen and an attempt made to straighten the kinked gut. The patient was practically pulseless. The intraabdominal administration of oxygen was followed by prompt improvement in pulse, respiration and general condition. The patient rallied from shock, vomiting ceased, and she did as well as could be expected as long as the oxygen remained in the abdomen, but when the gas was all absorbed, she succumbed from asthenia four days after the operation. In this case the supporting effect of the oxygen was remarkable.

5. M. B., age twenty-nine, single. Patient was operated on November 6, 1908, for fibroid tumors of the uterus, cystic ovaries, chronic appendix and tuberculous peritonitis. Following this operation, warm oxygen was introduced into the abdomen, and the wound closed. A second operation was performed July 18, 1912, for intestinal stasis. The small intestine, for about two feet from the junction with the large, was kinked at an acute angle, and fastened against the abdominal wall. After eliminating the kinks and suturing the intestine, a careful search was made for evidence of tuberculosis, of which not the slightest trace was found, not even the retroperitoneal glands being enlarged. The large intestine showed no ulceration, proving that the patient had been completely cured of the intestinal tuberculosis.

6. M. O., age fifty-three, married. At operation, November 18, 1908, this patient's right ovary was found to be the seat of a very large cyst which had become adherent to the stomach and other viscera in the upper abdomen. There were multiple uterine fibromata. Panhysterectomy was performed, only the tip of the cervix being left. The entire mass weighed sixty-one (61) pounds. Several pints of ascitic fluid were evacuated from the peritoneal cavity. Shock was very great. Oxygen was introduced until the abdomen was ballooned to very nearly its size previous to operation. The patient's condition immediately improved. During the entire time the oxygen remained in the abdomen, between thirteen and fourteen days, the face was somewhat flushed, the lips more than ordinarily moist and red. There was no nausea, no vomiting, and no paralysis of the intestine in spite of the previous intraabdominal pressure. The patient's recovery was uneventful and in 1920 she was alive and well.

In surgical shock, blood transfusion, intravenous injection of gum arabic, oxygen inhalation and oxygen per enema are methods now in use. Air is occasionally employed to secure intraabdominal pressure but the pulse and respiration do not react as quickly under air as under pure oxygen. Saline solution introduced into the abdomen and hypodermoclysis are both stimulants for respiration. However, the saline solution is very quickly absorbed and is but a temporary stimulant, often followed by a greater fall in blood pressure.

In the World War the subject of shock was very much to the fore and various theories as to its primary cause were advanced. Crile's deduction is that of adrenal and nerve exhaustion. Cannon's expla-

nation—an accumulation and stagnation of blood in the capillaries, so that the blood is removed from currency—and Bayliss' theory of lack of adequate blood supply at the vital organs and nerve centers, are factors, doubtless, in the causation of surgical shock.

In the last analysis, however, shock probably is a multiplex condition and, among other causes, it seems evident that it may be produced by an engorgement of the blood vessels, especially in the abdomen, either from the removal of a large tumor or the withdrawal of a considerable amount of fluid. Years ago, surgeons realized the importance of supporting the organs of the abdomen, the vessels, etc., after operations for abdominal tumors. McBurney, following severe laparotomies, strapped the abdomens of his patients with bath towels to keep, as he said, the blood from centering in this region. Of course, we know now that, for obvious reasons, this procedure did not accomplish the desired result but the idea had a very important and far-reaching inference.

The introduction of oxygen in the peritoneal cavity, after the removal of a large abdominal tumor or a considerable amount of fluid, permits the abdominal viscera to resume their normal positions gradually. Without this oxygen pressure, or its equivalent, collapse of the organs usually follows the removal of the mass. The walls of the vessels are accustomed to the intraabdominal pressure and, when the support is removed, the walls become flabby and give way quickly. Any method which produces postoperative intraabdominal pressure lessens the engorgement, prevents dilation and a resulting tendency to paralysis of the vessels of the splanchnic viscera. Therefore, it would seem evident that when oxygen is introduced into the peritoneal cavity after operation, it is an agent of distinct value in *prevention* of shock or in the *treatment* of shock when such a condition exists.

Clinically, oxygen has been utilized in innumerable ways. As early as 1799 Beddoes employed oxygen for the cure of ulcers of a "mauvaise" nature. In 1861 Mauiere and Gimbernat used injections of sterilized air in the treatment of hydrocele, and Marcane and Demarquay, in 1865, announced the cure by oxygen injection of a case of senile gangrene. Other authors cite the local use of the gas in furuncles, renal fistulas and psoas abscesses.

In an earlier paper, June, 1909, I reported cases of tuberculous ulceration of the intestine, tuberculous peritonitis and other infective processes cured by oxygen injection.

In cirrhosis of the liver, with ascites, where frequent withdrawal of the fluid was necessary, I found that the intraabdominal introduction of oxygen often increased the length of the intervals between the necessary tappings. The patient himself frequently mentioned the tonic effect of the oxygen. In flabby abdomens, where extensive operative manipulation had taken place, or where there had been great abdom-

inal pressure from a large tumor or considerable fluid, the introduction of the oxygen, with the mechanical supporting effect of the gas, seemed to act as a distinct factor in the prevention of ileus.

The beneficial influence of oxygen inhalation upon the digestive system is fully recognized and its bactericidal and antiseptic properties are conceded. However, from the results already secured, it is evident that there are still unrecognized therapeutic uses for the gas and a large field for further intensive research where the clinical and surgical possibilities of oxygen are to be considered.

34 GRAMERCY PARK. (*For discussion, see p.* 434.)

RHYTHMIC ELECTRIC WAVES IN GYNECOLOGY*

BY G. BETTON MASSEY, M.D., PHILADELPHIA, PA.

ONE of the recent advances in the use of electricity in gynecology is the development of apparatus for the rhythmic stimulation of muscular tissue, both smooth and striated, and of the neurons supplying such tissues. By the action of these machines the current used is turned on by the mechanism smoothly and painlessly to the strength desired to produce a single muscle and nerve response, and is then turned off with equal smoothness and painlessness, followed by a period sufficiently long for repose before the next wave is turned on. By the older method this alternate contraction and repose was difficult to produce by hand, and the continuous excitation of an unvaried current was rather fatiguing than helpful to muscular tissues, though still useful in action on nerves.

The waves produced by the modern apparatus may be called rhythmic if the frequency of the waves is made to correspond, or approach near to, the normal rate of contraction of the neuromuscular parts stimulated, or are not so frequent as to interfere with the normal tonal impulses. For instance: it is probable that the semivoluntary muscle bundles of the pelvis would be quickly fatigued if compelled during a prolonged treatment to contract much oftener than about 25 times per minute, while contractions at a rate from 10 to 25 per minute do not seem to fatigue the patient, are not unpleasant, and are a valuable remedy in relaxed conditions.

Confining myself to this one subject in the broad field of electricity in gynecology, I shall discuss in this brief paper the two kinds of rhythmic waves of electric power available in this work, and indicate the differing action they exert on the semivoluntary muscles of the pelvis; on uterine tissue; and on the muscular coats of the intestines. It should be understood that these waves are all of low frequency cur-

*Read before the New York Electrotherapeutic Society, November 2, 1921.

rents, and are in no way similar to high frequency currents, and that the indications for their use are the strengthening by exercise of atrophied, torn or relaxed muscular tissue, both striated and unstriated.

The action and value of diathermy and nonrhythmic currents in gynecology is quite another and a most important subject, and is best considered separately.

There are but two rhythmic waves now available in pelvic applications: the slow galvanic sinusoidal wave and the slowly-surging alternating current wave.

The galvanic sinusoidal wave is, as seen in Fig. 1, a direct or galvanic current, or what might be called a continuous stream of elec-

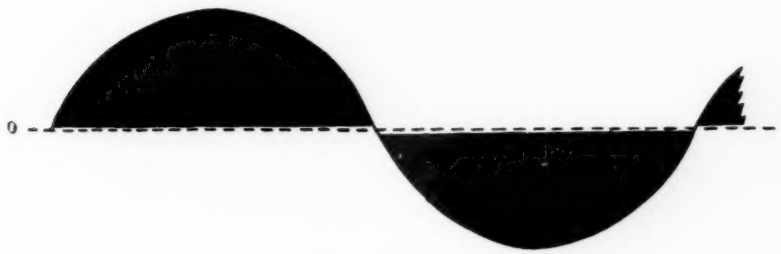

Fig. 1.—16 watt galvanic sinusoidal waves.

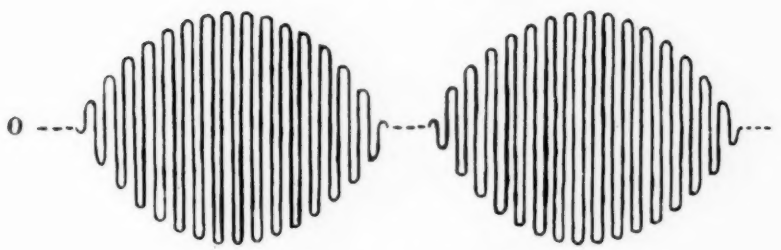

Fig. 2.—3 watt alternating current surges.

trons, that is smoothly turned on and increased by the machine as it passes through the patient to the strength selected, at which point it recedes to zero at the same rate of time and smoothness, the direction of the current being then mechanically reversed and the procedure repeated with changing polarity in each wave as long as desired.

The surging alternating current wave, (Fig. 2), is created by the surging by the machine of a current that is already alternating from 4000 to 7000 times per minute. To get the slow wave effect essential to rhythmic contractions it is mechanically surged into a rhythmic wave, which may be as slow, or even slower, than that produced by the galvanic apparatus.

Granting that we may obtain waves of the same periodicity suitable to our work from both of these machines, the question arises in what

way do they differ as articles of the materia medica in their gynecologic applications.

The answer is: that their chief clinical difference lies in the *duration* of the individual stimuli in the two waves. Take waves, for instance, of 30 per minute. The apex of such a wave or surge would last about a second. In the galvanic wave each wave constitutes an individual stimulus, lasting the full second.

In the alternating current surge this apex of the surge (a second in duration) contains about a thousand or more distinct stimulations, and, more important still, each stimulus exceedingly brief in its own duration, something like the one-fourhundredth of a second. To lengthen the surge would not increase the duration of any one of these brief stimuli.

Now physiologists have long since shown us most positively that the brevity of an induction impulse or wave fits it only for stimulation of normal neurons and normal striated muscular fibers, and that a much longer stimulus is required for degenerated voluntary muscles and normal involuntary muscles.

The therapeutic indications are, therefore, that in the stimulation of organs containing unstriated muscle fibers the galvanic wave is more effective in both health and disease. In organs made up of striated muscle, on the other hand, the alternating current wave is just as effective as the galvanic wave in the absence of true degeneration of the muscle. Whether pelvic muscles torn at childbirth present this degeneration depends on whether their motor neurons were also injured during parturition, causing Wallerian degeneration and the Reaction of Degeneration, in which case the galvanic wave will be most effective.

But I should not fail to mention that an important advantage of the galvanic reversal waves over the alternating current waves in weak muscles, with or without reaction of degeneration, is the fact that galvanic waves following each other in alternate reversed directions not only give sluggish muscles a long enough time to contract and relax fully, but time for each polarity to impress itself on the muscle or neuron so fully that the next polarity impressed in the same spot is doubled in efficiency by the release of stored energy—stored in the muscle by chemical change exactly as happens in a storage cell, and that the release of this stored energy occurs with the next wave, being in the same direction. This the physiologists have verified in most laborious experiments, calling it electrotonus, accompanied by explanations so far fetched and mentally confusing that all practical clinicians have tried to forget the whole subject. But the facts of the accentuation of response after reversal of a galvanic current have been fully verified, and only needed modern electrical conceptions to interpret them.

There are certain practical disadvantages attending the use of the machines producing galvanic waves. They are less perfect in con-

struction and more likely to give shocks by poorly acting moving parts. A motor generator is required to produce the galvanic current for their operation when the street supply is alternating. A slight electrolytic effect is produced on nickel plated vaginal or uterine electrodes but no lasting electrolysis or irritation of the tissues, and an indifferent pad with a better contact than generally used is to be advised when large currents are to be used with comfort to the patient.

The slight corrosion of the internal electrode is best met by the use of a copper ball or short cylinder (one by two inches, with an eight inch insulated stem) for the vagina that is kept amalgamated with quicksilver, and appropriate sized intrauterine copper sounds also amalgamated with quicksilver, the mercury surface readily absorbing any irritants temporarily formed during the waves and before the next wave has neutralized it. Kaolin pads form the best dispersing electrodes.

The alternating current wave generators are more fool proof, and may be turned over to an intelligent office nurse after the first treatment to a given patient. This wave is more soothing to the patient's nervous system, and seems to be fully effective in restoring tone to the voluntary muscles.

A few words should be said of the uterine muscle specifically in relation to these two waves. According to Morgan (Electrophysiology, New York, 1868, p. 701), T. Korner discovered through experiments on animals that the uterine muscle contracted most energetically when waves of the direct current were used. As to the proper periodicity of such stimulated contractions, it is possible that tonal impulses occur in the unimpregnated uterus at the same rate as the "pains" of childbirth.

Concerning the intestinal muscle, all physiologists agree that these muscles contract more energetically under galvanic waves than under the briefer induction waves. If this be true when the metal electrodes are applied directly to the muscular layers of the intestine how much more must it be true of currents through the abdominal wall. Yet, on the other hand, I am sure that the large wattage of the Morse type of alternating wave generator does increase peristaltic action, the only possible explanation being the very great wattage of the waves of this generator as compared with the old faradic currents, this great wattage overcoming the effect of the slight duration of the inductions of which the waves are composed. At any rate, many patients have quickened bowel movements after strong Morse surges, applied by large pads to the back and abdomen, those with thin abdominal walls being compelled at times to go to stool shortly after the application. This is true of these patients with both forms of rhythmic waves. How

much is due in either case to the powerful contractions of the abdominal walls inducing peristalsis and how much to direct action on the intestinal muscles remains to be determined.

It is evident that we have in rhythmic waves of wattages of about 12 to 16 watts galvanic and 2 to 3 watts alternating current, a means of restoring function of the pelvic muscles after perineal tears, either with or without operative repair, if the applications are persistently given for weeks or a month or so.

In all degrees of uterine prolapse rhythmic currents are useful and at times curative, reposition preceding each application. Either wave may be employed.

In subinvolution of the uterus the galvanic wave is indicated. In both prolapse and subinvolution the vaginal electrode may be used instead of an intrauterine electrode, a distinct advantage when it is recalled that these applications must be made daily or tri-weekly for a considerable period. The dispersing pad is on the abdomen. Unlike intrauterine applications, the vaginoabdominal applications give some sense of relief at once, without the temporary discomfort attending intrauterine interference.

An hypertrophied cervix, on the other hand, needs intrauterine rhythmic applications at intervals of one week, preferably powerful galvanic waves, interspersed with more frequent vaginoabdominal applications of the Morse waves. The quick relief from discomfort and early shrinkage of the elongated cervix is most marked under these applications, and it has been my experience that greater after-comfort is experienced by patients so treated than by those in whose cases the cervix has been amputated.

Probably the most frequent indication for the vaginoabdominal application of either form of rhythmic wave is the neuromuscular impotence of multiparae who have relaxed pelvic muscles from several slight muscle tears, too slight and too multiple for effective joining of the torn ends; or who have general muscular weakness without tears. Here the effect of routine applications on the power and completeness of the contraction of all the muscles of the pelvis, at the slow rate of 10 to 25 waves per minute, can be readily judged by the grasping effect on the vaginal instrument, and the progressive increase in muscle power during the weeks or months of treatment.

In conclusion I wish to repeat that this paper is confined to the consideration of the rhythmic wave of electric power as a neuromuscular stimulant and tonic in gynecology, and does not cover the extensive surgical and medical fields of nonrhythmic currents.

1823 WALLACE STREET.

Society Transactions

AMERICAN ASSOCIATION OF OBSTETRICIANS, GYNECOLOGISTS, AND ABDOMINAL SURGEONS. THIRTY-FOURTH ANNUAL MEETING HELD AT ST. LOUIS, MO., SEPTEMBER 20, 21, AND 22, 1921

(Continued from the March issue.)

DR. JAMES E. SADLIER, of Poughkeepsie, N. Y., read a paper entitled **A Study of the Cases of Carcinoma Mammae Operated upon by Myself and the End Results Obtained.**

This paper appears in full in the current volume of the official transactions, Vol. xxxiv, 1921.

DR. ROBERT E. FARR, Minneapolis, Minn., read a paper entitled **Gynecological Operations Under Local Anesthesia.** (For original article see page 400.)

DISCUSSION

DR. GEORGE GELLHORN, ST. LOUIS, MISSOURI.—I am filled with admiration of the ingenuity which led to the perfection of all these methods. To my mind the development of local or any anesthesia that is apt to restrict inhalation anesthesia is a great step forward in the safety and success of our operations. I have learned a great deal this morning and shall begin to emulate, as far as possible, the work of Dr. Farr. I have been using local anesthesia in the work upon the cervix and have found it very simple. I have, however, been unsuccessful in working upon the perineum and would ask Dr. Farr to touch upon this in his closing remarks. I have tried to block the perineal nerve where it curves around the spina ischii, but my efforts have thus far been unsuccessful.

I am particularly impressed with the procedures that take the comfort of the patients into consideration, such as their being lifted about.

DR. A. J. RONGY, NEW YORK CITY, N. Y.—There is no question but that Dr. Farr has worked out local anesthesia very beautifully, but I believe the operator is not quite free to discuss the advantages and disadvantages of the operation when the patient is fully conscious, and that robs it of its usefulness in teaching when the patient is in the operating room. I have had some experience with sacral anesthesia in varous operations and, it seems to me, that some trophic disturbance takes place and the wound union is not so good as it might be. In one case a recto-vaginal fistula developed. I would like to know what Dr. Farr's results are. Is his percentage of primary unions as good under local as under general anesthesia?

DR. WILLIAM SEAMAN BAINBRIDGE, NEW YORK CITY.—Referring to Dr. Rongy's remarks, it has been my custom to do practically all goiter work under

local anesthesia. I have been unable to detect any difference in healing when the patient is given local anesthesia or placed under a general anesthetic, neither have I found local anesthesia of any great disadvantage in teaching. A preliminary dose of morphine usually dulls the general sensibilities sufficiently. A touch of psychic anesthesia is of value, tell the patient that what she is doing is of great service to humanity; tell her a little of what is going to happen, and I think you will find that she will respond by helping the operator.

Regarding the addition of magnesium sulphate, I can only speak from experience with a few cases, but it seems that Gwathmey has added something to anesthesia —prolonging the effect and lessening certain disagreeable results.

DR. FARR, (closing).—With regard to the perineum, I would say that we use caudal anesthesia or an infiltration block. By going well out to the side there is nothing that can be injured, and by keeping the needle point on the move one may put in an ounce or two of the solution. In this way the nerve supply is sure to be reached.

My experience agrees with that of Doctor Bainbridge. This can be made an absolutely painless operation. Infiltration can be done in two minutes and it is so simple that I have for many years used only local anesthesia in these cases.

Charity cases are not good subjects for the use of local anesthesia, unless one has a reputation with this class of people for doing painless operations. I tried to develop my technic for local anesthesia upon this class of cases at the time I was teaching in the University of Minnesota. In 1914 I resigned so as to devote myself entirely to my private practice, for I found that I could get along so much better in the work when operating upon patients with whom I was acquainted.

We never talk to our patients before operation, if we can avoid it. If the patient brings up the subject, I ask her whether she is not willing to leave the details to me, and, as a rule, patients will say "Go ahead, and use your own judgment."

We have done approximately seventy-five abdominal hysterectomies, 25 per cent of which included the removal of the cervix. We have also done twelve or fifteen vaginal hysterectomies. We, therefore, believe that with a little experience men should do at least the simple things under local anesthesia, on account of its safety and other advantages.

We have had no difficulty with healing of wounds.

DR. WILLIAM EDGAR DARNALL, of Atlantic City, N. J., read a paper entitled **Suppurating Uterine Myomata.**

This paper appears in full in the current volume of the official transactions, Vol. xxxiv, 1921.

DR. K. I. SANES, of Pittsburgh, Pa., read a paper entitled **Ureteral Obstruction.** (For original article see page 405.)

DISCUSSION

DR. JOHN O. POLAK, BROOKLYN, NEW YORK.—The paper of Dr. Sanes brings out something of considerable interest to the gynecologist. All of us who are operating in teaching hospitals find great numbers of these surgical derelicts who have been operated two, three, or four times for appendicitis, adhesions and the like; and we have learned that the department of gynecology must include a department

of urology in order to make the diagnosis in these pelvic cases, for the reason that most of the cases give a history of starting during pregnancy or after labor. All of us know that there is considerable trauma during labor and that parametritis is much more frequent than any one supposes unless one is making examinations in a postpartum clinic. When one opens the abdomen and finds the pelvic veins obstructed and the ovaries adherent in every case where a parametritis has been present, one can see how this same scar tissue can constrict a ureter and produce sufficient stasis in the ureter to cause intermittent hydroureter. A great many of these cases, as the doctor said, have these strictures. They are more frequent than stones and cause intermittent hydroureter and hydronephrosis.

DR. E. GUSTAV ZINKE, CINCINNATI, OHIO.—How do you differentiate between a shadow that represents a stone and a shadow that is created by some other body not in the ureter, perhaps beneath it, above it or to one side of it?

DR. SANES, (closing).—Dr Polak's remarks are correct. We have frequently found these patients giving a history of preceding pelvic inflammation. An inflammation of the pelvic organs may, by extension, affect the periureteral and ureteral tissues, causing constriction and ureteritis. Dr. Zinke's question I think is answered in the paper. One of the slides showed a shadow of a calcareous substance outside the ureter, demonstrating the x-ray catheter. If we find a shadow outside of the ureter we know that it is not caused by a stone. We do not diagnose a stone unless it is in the ureter, in immediate contact with the ureteral x-ray catheter.

DR. R. R. HUGGINS, of Pittsburgh, Pa., read a paper entitled **The Indications for and the Dangers in the Use of Spinal Anesthesia in Obstetrics, Gynecology and Abdominal Surgery.** (For original article see page 412.)

DISCUSSION

DR. GEORGE GELLHORN, ST. LOUIS, MISSOURI.—I want to endorse what Dr. Huggins has said. I believe firmly, as he does, that spinal anesthesia forms one of the most valuable aids to our operative procedures. Have you noticed how inconsistent we are? We preach to the profession and laity about the right of the patient to be considered individually and claim that every case should be treated on its merits, and then we calmly go ahead and carry out our routine. Thus, there are operators who operate on all kinds of patients under ether. They would not change from that habit for anything in the world. Conversely, there are others who do everything under the sun under spinal anesthesia. I am at this point at variance with a well-known surgeon in the east, who advises spinal anesthesia for everything. He does curettages, hysterectomies, and hemorrhoidectomies under spinal anesthesia. That looks to me like training a big cannon on humming birds. Spinal anesthesia must be reserved for major operations. I have used spinal anesthesia for more than eleven years on something like 600 cases, and would not give it up. The absolute contraindications are hypotension and kyphoscoliosis or other deformities. There are also relative contraindications, such as a neuropathic disposition, a tendency to headaches, and skin eruptions at the site of injection. I cannot, however, agree with Dr. Huggins as to hypertension being a contraindication. On the contrary, I feel that such cases are eminently well suited for spinal anesthesia. Ether would be most dangerous, whereas in spinal anesthesia, the blood pressure will be reduced immediately. To prevent too rapid a fall of the blood pressure, adrenalin may be injected when the drop becomes manifest.

I regret the fact that our professional anesthetists, as a rule, limit themselves to one or two methods of inhalation narcosis. In order to be true specialists, they should be experts in *every* kind of anesthesia or analgesia used in surgery.

DR. WILLIAM SEAMAN BAINBRIDGE, NEW YORK CITY.—Some years ago, when spinal analgesia was first brought before the profession, I put it to a thorough test, having special opportunity to do so at the New York City Children's Hospital and Schools at Randall's Island and at some other institutions. I employed it in 1600 cases of all kinds under varying conditions, using the method for operations below the clavicle. Many of the patients were poorly developed, undernourished children, and some were cases in which one would hesitate to use any form of anesthesia. The ages ranged from three months up to seventy-five years. The three months old child had a congenital cardiac disorder and a hypostatic pneumonia; it recovered perfectly except for the heart condition, which still remains. An interesting fact of the case is that during the entire operation the child nursed from a bottle.

I believe spinal analgesia has a place in surgery but is not without its dangers and should be very carefully employed.

DR. HUGGINS, (closing).—There have been two methods of preparing the solution, the heavier and the lighter. When alcohol is used it makes the solution lighter than the spinal fluid and we then elevate the head of the bed, thus allowing the fluid to drift toward the base of the column rather than toward the medulla. We have felt that this is more effective, that alcohol slowly introduced gives us a better anesthesia.

One thing in regard to high blood pressure, as brought out by Dr. Gellhorn. I am thoroughly convinced that is where we get into trouble sometimes. A man will give one or two or three hundred spinal anesthesias and then a patient will die suddenly and they will throw the method up. That is what happened in the genito-urinary clinics down at Baltimore, they would not give it because some old men died. In such cases the patients should not have been given spinal anesthesia for they had inelastic arteries and they do not withstand the change.

We must be careful about that one thing, and if we are careful about the fundamental principles I think we will keep out of trouble.

DR. JOHN W. KEEFE, of Providence, R. I., read a paper entitled **A Plea for Routine Examination upon the Operating Table as a Preliminary to Abdominal Operations.**

This paper appears in full in the current volume of the official transactions, Vol. xxxiv, 1921.

DR. WILLIAM S. BAINBRIDGE, of New York, N. Y., read a paper entitled **Oxygen in the Peritoneal Cavity with Report of Cases.** (For original article see page 424.)

DISCUSSION

DR. A. J. RONGY, NEW YORK CITY.—My experience with the introduction of oxygen into the peritoneal cavity is practically limited to a study of the patency of the fallopian tubes. When Dr. Bainbridge began the study of oxygen he had no way of measuring accurately the quantity he had introduced into the abdominal

cavity. Now we have instruments by which we can accurately measure the quantity used. Not a great deal of oxygen need be introduced into the abdominal cavity to cause pain. A column of oxygen forms between the liver and the diaphragm as soon as the patient assumes an erect position which causes painful pressure on the diaphragm. One of my patients went into syncope on the table. It is safer to use carbon dioxide on account of its rapid absorption. It takes twenty-four to forty-eight hours for oxygen to be absorbed and during that time the patients have a great deal of pain in the abdomen and also in the right shoulder. They feel as they usually express it, that "they are almost paralyzed on the right side."

DR. STEPHEN E. TRACY, PHILADELPHIA, PENN.—I would like to know whether Dr. Bainbridge obtains better results with the use of oxygen in his cases of tuberculosis of the peritoneum than he did in cases not treated with oxygen. My experience has been that if the source of infection is removed and the abdomen closed the results are good. We have used oxygen in the treatment of tuberculous sinuses, and it seemed that they healed in a much shorter time than those treated by other methods.

DR. H. J. SCHERCK, ST. LOUIS, MISSOURI.—I wish to say a few words on the question of pneumoperitoneum, not so much from a therapeutic as a diagnostic standpoint. I would like to say that the technic worked out by me and my associates has served to make the diagnosis between intraabdominal and extraperitoneal tumors perfectly clear without exception. The method is very simple. A large block of wood is placed under the thorax and underneath the pelvis, allowing the abdominal contents to sag, and after this the abdomen is distended, using air. Oxygen is introduced under pressure from the tanks and we produce our own pressure. If a tumor is situated retroperitoneally the clear prevertebral space can be seen impinged upon by the tumor mass, and you can make a diagnosis at once between the intraabdominal and retroperitoneal growths.

I have not observed in our series a single alarming symptom. I have noticed the pain in the shoulder referred to by the last speaker. We did have a certain amount of emphysema following but since we have adopted a little apparatus designed by Dr. Sante placing between the tube and the needle, a manometer from an ordinary blood pressure apparatus, we can determine whether the needle is in the abdominal cavity or in the gut or tissue. If pressure is registered we know we are up against an obstruction.

There was another experiment of particular interest to me and that was some other work that we have been doing in reference to fluoroscopy in conjunction with the pneumoperitoneum and the injection of the ureters and pelvis of the kidney. We have introduced 15 to 25 per cent bromide of soda when the pneumoperitoneum was made. We get a much better view in that way than without the distention of the abdomen. I think we were the first to suggest this. If the air in the abdomen is in the way it is easy to remove it before the patient is put back to bed by leaving the needle in and simply pressing it out.

We had a type of case not mentioned by the essayist, an intraabdominal hemorrhage due to traumatism. In this case we were unable to tell whether or not there was a rupture of the gut. So we took a picture to determine whether there was a rupture, believing that there would be enough gas admitted into the abdomen from the bowel to show whether the gut had been ruptured. In this case there was enough gas to determine this point. In the next case we found no pneumoperitoneum and upon laparotomy found a rupture of the kidney and then after operating on the case we distended the abdomen with air in order to sustain intraabdominal

pressure. As soon as the intraabdominal pressure is reduced, the hemorrhage will start again in many of these cases.

DR. BAINBRIDGE, (closing).—Dr. Rongy has had experience with the adulteration of oxygen. I, too, have spent much time in testing the quality of oxygen on the market. We must be just as careful in regard to the purity of the oxygen we use as we are with digitalis, atropin, or any other drug.

I have not had the experience mentioned by Dr. Rongy in regard to syncope and invalidism. In my reports on this subject, the first one published in 1908, you will find that very few patients have any annoying effects whatever from this procedure. One woman I tapped 134 times and usually introduced oxygen into the peritoneal cavity, at her request. After a few hours she was always able to return to her work as Probation Officer in a suburb of New York. I have had scores of cases markedly benefited through this means. I believe we have here a therapeutic agent in selected cases.

Dr. Tracy has spoken of tuberculous peritonitis; I think oxygen is just another element of help. We have all seen these cases get well with only a laparotomy.

The point about hemorrhage is a very good one, and you will find that in my paper published in 1908 I speak of the prevention of secondary hemorrhage by the pressure of the volume of gas.

THE NEW YORK OBSTETRICAL SOCIETY. MEETING OF DECEMBER 13, 1921

The President, Dr. Ralph H. Pomeroy, in the Chair

Dr. Ralph Waldo read a paper on **Abdominal Drainage.**

Dr. Waldo referred to the wide differences of opinion still existing in the minds of experienced abdominal surgeons regarding this procedure, although if a thorough appreciation existed of a limitation of abdominal drainage, such differences in opinion would be less. He stated that except for the relief of ascites, either of local or general origin, there is no such thing as general abdominal drainage.

Drainage does not take the place of surgery, but on the other hand, if properly employed, assists very materially in the cure of many serious abdominal diseases. It will not remove a pus tube, a gangrenous appendix, or gall bladder. In a very limited number of cases where the offending organ has been practically removed by an abscess, it may be good surgery to only drain the abscess, especially if the patient's general condition is bad.

In all of these cases it is regional and not general abdominal drainage that is employed.

Dr. Waldo advised drainage where there is a markedly infected area or where there have been extensive adhesions from which there is more or less oozing of blood and from which there is likely to be an exudation of serum for several days. In the last instance quite a large amount of blood and serum is apt to accumulate, which would act as a culture medium for the few infecting germs that are sure to be present and which under ordinary circumstances would be taken care of by the peritoneum. This infected blood and serum is sure to result in general infection that may cause the patient's life. A properly applied drain will prevent this by not allowing a culture medium to collect. The drain in this class of cases is called upon to do two things. The first and possibly the most important is to hold the abdominal contents (intestine, omentum, and mesentery) as much as possible away from the infected area. The second is drainage. A drain does not

directly cure sepsis; but on the other hand in properly selected cases, it prevents the addition of septic poison to a patient who is usually more or less infected.

During Dr. Waldo's early work in abdominal surgery, glass tubes, rubber drainage tubes with lateral perforations and then strips of gauze, usually iodoform were used. It soon became apparent that these methods drained only a very small area and that very imperfectly. Many times, when tubes were used, intestinal fistulae resulted.

About twenty years ago, he had many cases of severe pelvic infection to treat, and also quite a number of adherent tumors to remove by abdominal section. In a limited number of cases, there was much bleeding and packing with iodoform gauze as recommended by *Mikulicz* was used. In some of these cases there had been severe infection with the presence of more or less infected pus. In other cases there was no infection.

To the surprise of all who observed these cases, the infected patients did as well as the noninfected cases. With a prejudice against placing iodoform gauze in contact with the peritoneum, the large piece of gauze in the Mikulicz abdominal tamponade was replaced by plain sterile gauze. Strips of iodoform gauze are still used as a middle packing. No silk thread is attached to the middle of the large piece of gauze as advocated by Mikulicz. The drain is at least one to one and a half inches in diameter where it passes through the abdominal wall and great care is taken to see that it is not constricted at that point. On the fourth or fifth day after the operation, the interior packing of iodoform gauze is gently loosened and usually partially removed. Each day thereafter, a little more is taken until at the end of the week after the operation, it is all removed. In two or three days after, the remaining large piece of gauze is easily removed and as this frequently leaves a fair sized opening, a strip of gauze, or piece of rubber tissue is introduced and changed daily for a few days until the opening is entirely closed, which is usually two or three weeks after the operation.

Where the drain is left in as long as here recommended, there is never any protrusion of intestine or omentum, and hernia in the abdominal wound very rarely follows. Three months after the operation, from the appearance of the wound, it is very difficult to detect that the abdomen has been drained. This method keeps the abdominal contents away from the infected region and also prevents the accumulation of blood and serum. It drains the infected region. It is not a drain to the general abdominal cavity. A strip of gauze, small cigarette drain or tube, either glass or rubber, does not drain the general abdominal cavity, nor does it effectively drain a region. A tube is liable to injure the neighboring structures.

DISCUSSION

DR. HOWARD C. TAYLOR.—An experience of the past I value very highly is that in connection with abdominal drainage and I think it is an experience that those of us who have been practicing surgery for many years have had, which the younger men can never have. My first training in surgery was at Roosevelt Hospital and practically no abdominal work was done without some drainage. Even a simple appendectomy would be drained down to the stump. The result was a large number of sinuses because of the packing and drainage employed. After training on the surgical service I went over to the gynecological service of Dr. Tuttle, and it was strange that conditions could be so different in two services in the same institution. The plan of Dr. Tuttle at that time was this: if we had a double pyosalpinx or anything where there was need of drainage, a glass tube put down to the bottom of the wound, that was cleaned out until the discharge lessened. Then two or three silkworm gut sutures which were left in place were tied and the abdominal wall was closed entirely though a certain amount of fluid

was left in the peritoneal cavity. Those cases did perfectly well. In other words, the method pursued by Dr. Tuttle was a very marked advance over the constant packing and drainage as practiced by Dr. McBurney. It seems to me that what Dr. Waldo has said is true in regard to the question of the necessity of drainage. We cannot drain the peritoneal cavity, you simply drain the condition that is left at the end of the operation, and not the condition that was there at the beginning. If there is any infected tissue left, it must be drained and taken care of; otherwise a general peritonitis will result. If everything is left clean, drainage is not necessary. I very rarely drain through the abdominal wall, because it is much better to drain through the vagina.

DR. WILLIAM E. STUDDIFORD.—I have gone through about the same experience as Dr. Taylor on the subject of drainage. One important fact that we have learned is when to operate. Formerly we invaded the "acute" abdomen and operated on a good many cases that might have recovered or had partial resolution and less severe operation if they had been let alone. Studies of infected tubes show that, in the majority of cases, they are sterile, even in the presence of large collections of pus, and the majority of such cases are to be drained through the vagina.

The cases in which I use drainage, but more as a safety valve, rather than for the principle of drainage itself, are the cases in which there have been a great many adhesions, in which there is a good deal of oozing into the culdesac from the peritoneal surfaces. I think in that particular type of case a puncture of the posterior vaginal wall and a packing with a cigarette drain, or even iodoform gauze into the culdesac at least, gives an outlet to the accumulation which may be present and very rarely does any harm.

I can recall only one case in the past two years in which I used abdominal drainage, in which there was an adherent tube and ovary between the bladder and the peritoneum of the anterior abdominal wall. When I completed the operation there was a raw bleeding surface between the bladder and the anterior wall, and instead of the old fashioned drainage gauze, I simply introduced a little rubber tissue drain through the lower angle of the wound going to the bleeding surface, which was left in for about forty-eight hours and then withdrawn.

Dr. Waldo's description of the Mikulicz pouch reminded me of my first experience with it, when I was a house surgeon at Bellevue Hospital. Dr. Lusk, who was the attending surgeon, had been abroad that previous summer, and came back, having seen Mikulicz use his pouch. It was packed into the culdesac and a long strip of iodoform gauze was packed through the middle of it. I remember in those days we used silk ligatures in the broad ligament and rather heavy silk at that. We got the gauze out of the pouch and then came the day to remove the outside pack, which Dr. Lusk did himself. With the pack in the case to which I am referring came both the ligatures from the ovarian arteries, then a stream of blood shot up, and the woman immediately went into collapse. Dr. Lusk immediately repacked the wound. The woman got well, but she was not so fortunate as Dr. Waldo's case, because she developed a large ventral hernia. I have always been skeptical about the Mikulicz pouch ever since that experience.

DR. RALPH WALDO (closing).—I fully approve of that telltale drain about which Dr. Taylor and Dr. Studdiford have spoken.

I don't want to create the impression in anybody's mind that I drain very frequently. I formerly used to drain quite frequently. I don't drain now unless there is a good reason for it.

Another thing about the acute cases: I was criticized quite severely a few years

ago because I would not operate on acute infections of the pelvis, tubes and ovaries. At the present time there is no abdominal surgeon who would operate on acute cases.

DR. FREDERICK C. HOLDEN read a paper entitled: **Are the Operations for Absence of the Vagina Justifiable?**

The question of operation for the construction of an artificial vagina has been brought rather forcibly to my mind on several occasions during the past few years. At an autopsy held recently at the City Mortuary the specimen shown was removed. It illustrates, perhaps, the most frequently used operation, the so-called Baldwin operation, or ileac substitution. This subject was operated upon in a small New York hospital and I submit the following quotation from the autopsy report of Dr. Charles Norris, to whom I am indebted for the privilege of presenting it.

"Small intestines: Mucous membrane normal with the exception of a few reddish areas in lower part of ileum. A loop of ileum is adherent to the vagina and when separated there is found an opening about ½ inch in diameter. Part of the mesentery has been removed at operation, in which place there are sutures. There is a lateral anastomosis of the ileum near the cecum, sutures being present, the communication being free, the lumen being somewhat narrow. There is an opening connecting the pelvic cavity with the vulva. Bladder is normal, there being infiltration with blood in front of it. There is an ovary on each side about normal in size, and internal to it on either side connecting with the broad ligament, there is solid tissue somewhat elongated, about 1 inch in length by ⅜ to ½ inch in width and thickness, which on section is firm. Microscopic section of this tissue shows it to be typical uterine structure."

To my mind an operation is not justifiable if it carries too great a mortality rate, and it must substitute a reasonable degree of improvement in the anatomical and physiological state. There are, at present, three types of operations used for the formation of an artificial vagina. First and most commonly the substitution of a section of the ileum, the Baldwin operation; secondly the substitution of a portion of the rectum, Schubert's operation; and lastly a plastic procedure using the skin of the vulva and thighs as devised by Graves. With Schubert's and Graves' procedures I have had no experience and from collected reports they are apparently little used.

By personal communication with our confreres in this city, I have noted seven cases operated within the past few years with a mortality of three. I have, however, communicated with Baldwin and he reports fifteen cases with a mortality of one. From personal observation and communication I have arrived at the following conclusions:

1. The Baldwin or any other type of operation for construction of an artificial vagina is not justifiable in an unmarried woman who desires the operation that she may marry. The prime object of marriage is to beget children, and this type of woman surely can never conceive; her married life is bound to be unhappy and marriage upon her part should be discouraged and the operation not performed.

2. The Baldwin operation is justifiable in a woman already married, who finding the consummation of her marriage is impossible desires relief through operation and who thoroughly understands the mortality risks and the fact that the relief obtained is often decidedly unsatisfactory.

3. It is my opinion that the plastic operation of Graves and the rectal substitution of Schubert are very seldom justified, for they substitute at best a de-

cidedly unsatisfactory vagina, although undoubtedly they carry a much lower mortality rate.

DISCUSSION

DR. HIRAM N. VINEBERG.—I have done the Baldwin operation once with only partial success so far as the vagina was concerned. The patient made a very good recovery from the operation but the result was such that I did not consider it a very successful vagina, although it served the purpose fairly well. She was a married woman and desired to have some relief for otherwise she was going to be divorced. For the first few months it seemed to be fairly satisfactory, then I lost track of her. There is, however, in the absence of the vagina one condition which must be considered, namely, the absence of the lower third of the vagina. In those cases there is usually a rudimentary uterus and there is a vagina higher up. Those cases are very successfully operated upon; in fact, I have had occasion to do several myself. One dissects between the bladder and the rectum from below as far as possible and then does a laparotomy, pushes down the bladder away from the rudimentary uterus, finds the upper part of the vagina and introduces an instrument through the upper vaginal pouch until it reaches the space created by the dissection from below. A strip of gauze is left in the opening in the vaginal pouch and serves as a guide to connect the vaginal pouch with the skin outside. In one case that I did this operation, it was very successful. In this case there was only a small nodule the size of an almond representing the uterus. There is apparently no vagina present, but if you examine these cases *per rectum* you will find there is a small uterus and usually this upper part of the vagina is developed sufficiently to be brought down to the external skin and sutured to it, forming a very satisfactory and permanent vaginal canal.

DR. GEORGE G. WARD, JR.—I recall a case similar to those under discussion, one in which there was a rudimentary vagina present, but it was so small that its calibre was about that of a lead pencil. I operated on this patient in the Woman's Hospital. She had been previously operated on by an incision with an attempt at suturing the reverse way, without any satisfaction. I was able to get a flap from the labia minora, leaving it attached, and turned it in, thereby increasing the calibre of the vagina. The result was perfectly satisfactory, so I was informed by the patient.

I agree with the conclusions that Dr. Holden has drawn. In these cases of total absence of the vagina I doubt very much if any of them are really satisfactory and there is no question about the very grave risk that these cases must undergo.

DR. GORDON GIBSON.—I can add one Baldwin case to the record. This girl had been in several hospitals in Brooklyn and finally came into the Long Island College Hospital. She was most unhappy and wanted an operation done. She had the risk explained to her, knew what the proposition was and really demanded operation. The findings were surprisingly like those of Dr. Holden's specimen in that there was no vagina, rudimentary uterus and no fusion of the ducts.

The operation is not difficult at all, but the margin of error is tremendous. In the first place, you must get that part of the ileum so well mobilized that there is no tension on the mesentery; second, you must get the right length so that none of it hangs in the abdominal cavity after you get through.

This case which we did lived fourteen days. There was no reaction so far as the abdomen was concerned, but she had a terrific vaginal discharge. She died on the fourteenth day of sepsis. In the last few days we dilated up this artificial tract and evacuated the pus which had collected in a little loop of ileum which was

left at the top of the sinus. I would very much question the advisability of this operation and think I can subscribe to Dr. Holden's remarks that an operation of this kind is unjustifiable.

DR. J. RIDDLE GOFFE.—I had a case a number of years ago like that which Dr. Ward referred to in which the vagina had the caliber of a lead pencil. The clitoris was about 2½ inches long. This pseudohermaphrodite was in love with a man and wanted to get married, and came to me to have that organ removed and to be put in condition to be married. I studied the case for some time and finally decided that I could make an incision along the side of the vagina on either side and through the vagina until it would reach the proper capacity, and then make an incision along the dorsal side of the clitoris, or the penis, and then on the ventral side. After doing this I dissected off two flaps laterally and removed the clitoris and then carried these two flaps into the vagina in order to fill up the spaces on either side. The flaps adhered and when I discharged the patient she had a vagina of perfect functional capacity. I understood that she was married about six weeks afterwards and I learned that everything was satisfactory.

DR. FRANK R. OASTLER.—I can add one more case to the record. She was operated on in Vienna. An external flap-operation had been performed. The result was functionally good, except that the pubic hair had continued to grow in the vagina to such an extent that the new vagina was always partially blocked, so that the ultimate result of the operation was not very good. I am in accord with Dr. Holden's statement that this operation should not be done unless under extreme circumstances.

DR. FRANKLIN A. DORMAN.—I recollect a case at the Post-Graduate Hospital, a young Italian woman, of the thin, poorly-nourished type, who was very unhappy because her husband had told her that if he was not able to have intercourse with her he would leave her.

On examination of this woman no sign of a vagina was found although she seemed to be a normal female. I decided to try to make a vagina for her. We succeeded in getting an opening between the rectum and bladder and did the flap operation. The patient left the hospital after a reasonable time with a fairly adequate vagina, but it looked as though it was not going to stay. There her history ended until a year or two later, when she came back to the clinic with a friend. She looked well, happy and contented.

NEW YORK ACADEMY OF MEDICINE. SECTION ON OBSTETRICS AND GYNECOLOGY. STATED MEETING, HELD NOVEMBER 22, 1921

DR. HAROLD BAILEY IN THE CHAIR

DR. MILTON A. SHLENKER reported a case of **Hydatidiform Mole.**

Although this condition is supposed to occur only once in every 2400 cases, I have had occasion to present two other specimens before this Section within the year. I am presenting this case because of its typical symptomatology and the great difficulty we experienced in coming to a conclusion.

The patient, R. L., thirty-five years of age, an Austrian, came under observation on July 18, 1921. Her father died of carcinoma of the stomach at the age of forty-five years. She had been married fourteen years, had had four children

and no miscarriages. Her husband is well. Her first menses occurred at the age of fourteen years, were of the 8-day type, usually every thirty days. The last menstrual period was April 2, 1921. Appetite poor, and she is habitually constipated. She has had stomach trouble for the past ten years, and states that the doctor told her she had gallstone attacks. Her weight was 134 pounds which is ten pounds lighter than a year ago. She presented no bladder symptoms and denied history of venereal disease. She stated that about June 1, she began to bleed and at the same time suffered with cramps in the lower abdomen, and passed large clots. During the latter part of June she contined to pass clots but did not experience any cramps or abdominal pain. She was admitted to the Gouverneur Hospital on July 18, looking critically ill. Her teeth were poorly kept and many were missing. Her tonsils were enlarged and cryptic. The heart sounds were regular and of good quality, with a faint systolic murmur at the base, and a thrill in the precordial region. The fundus of the uterus was four inches above the symphysis. The abdominal wall was relaxed. There was no tenderness or tumor. Vaginal examination revealed a lacerated perineum, rectocele and cystocele, and bilateral laceration of the cervix. The uterus corresponded to a three months' pregnancy and was in the normal position. Palpation of the adnexa showed a small round hard mass the size of hickory nut on the left side, which was very tender on palpation.

On July 21, the patient complained of an abscessed tooth which was removed. On the following day she seemed much better. The bleeding had stopped. The uterus was still enlarged and the cervix firmly closed. The diagnosis was threatened abortion. The patient insisted in leaving the hospital against advice. On August 29, she was readmitted. She stated that after her return home she began to bleed and to pass clots more or less continuously, but she did not experience any pain whatsoever. About three weeks before she noticed that she began to sweat, and complained of backache, headache, and difficult vision. She stated that she passed dark colored urine freely. Had a bad taste in the mouth. She had not yet felt life. Examination showed the abdomen enlarged and prominent, with edema of the lower abdominal wall. The uterus was large, globular, and extended a little above the umbilicus. No fetal heart was heard, nor was ballottement present. There was also marked edema of the vulva and lower extremities. The blood pressure was 178/90. The specific gravity of the urine was 1034; albumin 4-plus, and many leucocytes and granular casts and red blood cells were present. The temperature was normal. On September 2 interruption of pregnancy was decided upon for a supposed toxemia. The cervix, which admitted one finger, was packed with iodoform gauze. Three days later the patient was bleeding profusely and was removed to the operating room and the cervix dilated. Grape-like bodies could be felt, but no evidences of a fetus. With the use of a sponge forceps large quantities of this material were removed from the uterus. The uterine cavity was thoroughly evacuated. The patient began to bleed profusely and caffeine and camphor in oil were given plus a hypodermoclysis of normal saline solution. After complete evacuation of the uterus it contracted down to about one-fourth its previous size.

The pathologic report stated that fragments of cyst wall and chorionic villi were found. The diagnosis was hydatidiform mole. The patient made an uneventful recovery, and was discharged September 18, apparently well.

On October 25 this patient was admitted to the surgical division of the hospital with a history of bleeding more or less at times since she left the hospital in September; the bleeding was of negligible quantity. On the morning of her admission she had bled profusely and complained of pains in her back and both sides of the lower abdomen. Her temperature was normal, pulse 62.

On October 26th she was operated on by Dr. Ladin and a large amount of tissue resembling placenta was removed. There was no evidence of products of conception. A laparotomy was performed and both ovaries found to be cystic, the right being the size of an orange, while the left was much smaller. A bilateral salpingooophorectomy was performed.

The pathologist reports that the scrapings were simply hypertrophied endometrium and that the ovaries had undergone a simple cystic degeneration.

DR. SHLENKER also reported the **Death of a Fetus in Twin Pregnancy Due to Twists in the Cord.**

Death as a result of this condition is supposed to occur within a few days prior to the delivery of the child. In our case the patient complained of excessive fetal movements about two weeks before her delivery, but had scarcely felt any life whatsoever after this period. The dead fetus was a male and decidedly more robust than the female child which was delivered alive and in good condition. The first child to be delivered was the dead male. The membranes were ruptured artificially, and much meconium was discharged with the amniotic fluid. On delivery the fetus did not breath, nor was there any beating of the heart, and all efforts to establish respirations were without avail. The second child was delivered by a breech extraction and without difficulty.

The specimen shows a single placenta with two cords, each coming from the opposite sides. Each child was contained in separate amniotic sac. The dead child was attached to the large half, which in the fresh state was pale in color and tough to the feel, and there was more or less of a demarcation line from the other half of the placenta which was apparently normal in consistency and otherwise.

DISCUSSION

DR. H. C. WILLIAMSON.—The toxic symptoms in the case of hydatidiform mole interested me. The patient had a low blood pressure and the urine showed albumin and casts, a kidney toxemia which was cured when the hydatid mole was removed. This I believe is an evidence that toxemia of pregnancy is due to syncytiotoxins.

DR. WILLIAM P. HEALY.—The case of hydatid mole has several very interesting features about it. Dr. Shlenker in his remarks drew attention to the unusual experience of having had three of these cases within a year, the specimens of which he has presented here. That indicates that he is more or less on the alert in regard to the diagnosis of cases of this kind, and in this instance the symptoms were not sufficiently definite to enable him to make the diagnosis. In other words, the symptoms were those of impending abortion. There was only one possibility of avoiding error and that might have justified his making the diagnosis of hydatidiform mole when the patient first came under observation, that was he mentioned that the fundus was four inches above the symphysis pubis. That would indicate a uterus somewhat larger than it ought to be at that period. However when the woman came under observation later, after she had been home for a time, it was evident that she had a very large uterus, larger than it should be and there were no fetal heart sounds. With these symptoms and the history of bleeding the diagnosis became an easier matter. Dr. Shlenker then removed the hydatid mole and cleansed out the uterus being careful not to use a sharp instrument. The patient then passed out of observation in absolutely good condition, the toxemia having subsided. The question that comes up is whether when she was first seen

she had the hydatid mole or whether the hydatid mole developed in an incomplete abortion. I do not see how we can answer that question, but we do know that a careful examination of the secundines microscopically has shown a very high percentage of hydatid degeneration. It is more than possible that the patient may have incompletely aborted and later developed the hydatid mole.

DR. BAILEY.—Perhaps some of you may remember that Dr. Vineberg reported before the New York Obstetrical Society a case of hydatid mole in which after leaving the hospital the patient had frank hemorrhage. She was brought back and the uterus was removed without further examination, and that uterus proved to have a chorioepithelioma in the fundus. The case brought up some discussion as to the advisability of going ahead and removing the uterus with only a history of bleeding following the removal of a hydatid mole. You may recall that some 13 per cent of women having hydatid moles die in the first place, and 15 per cent of the remainder develop chorioepithelioma. For this reason it is questionable whether the treatment should not be removal of the uterus. I have always done what Dr. Shlenker did, that is, dilate the cervix and attempt with the finger and sponge forceps to remove the hydatid mole. This woman should have had at the second operation a laparotomy and removal of the uterus. There were bilateral cysts of the ovaries which were simple cysts, but nevertheless it would have been better for the woman to have had the uterus removed for it is probable that a chorioepithelioma is growing there. Dilatation of the cervix and removal of the mole by sponge forceps is the usual, but cannot be considered as satisfactory, treatment for this condition.

DR. BAILEY.—It is exceedingly remarkable that the child in the case of cord dystocia should have grown to full size and did not die until a short time before birth.

DR. SHLENKER.—The fetus was slightly macerated. From the history of the case it would seem that the fetus had been dead for two weeks. It is still remarkable that the child should have grown all through the fetal period and obtained sufficient nourishment from that twisted cord.

Replying to Dr. Healy's inquiry as to the period of gestation when this mole occurred, this could have, in a degree, been determined by a microscopic examination. We know that after the third month of gestation, the layers of Langhans and the syncitium become fused into a single layer.

Answering Dr. Bailey as to the removal of the uterus for a hydatidiform mole, I would consider a panhysterectomy for this condition a rather radical procedure. It is our plan to carefully evacuate the uterine cavity, and thereafter keep the patient under careful observation for quite a long period. Had this patient been returned to our service, I would have, under the existing condition, performed a panhysterectomy, especially since this patient had bilateral ovarian cysts. We know that lutein cysts are now an etiologic consideration in chorioepithelioma. The pathologist reported these tumors of the ovaries as simple cysts.

I was deeply interested in this case of twisted cord with death of the fetus because of its extreme rarity. I have been unable to find any great number of similar cases reported. I noted where one case was reported in which there were 348 twists in the cord. This fetus while in fair state of preservation showed some evidences of postmortem changes.

Department of Reviews and Abstracts

CONDUCTED BY HUGO EHRENFEST, M.D., ASSOCIATE EDITOR

Collective Review

FEAR OF THE FETUS: AN ANCIENT CAUSE FOR THE CESAREAN SECTION

BY ALFRED ELA, BOSTON, MASS.

"THE fear of the spirits of the dead appears to have been one of the most powerful factors, perhaps, indeed, the most powerful of all, in shaping the course of religious * * * development from the lowest to the highest; and for that reason it is not specially characteristic of any form of society."[1, 2] Linked with this was the jealousy toward living mankind felt even by the Olympian gods[3] which they manifested by causing premature deaths.[4] This too was felt by demigods, the belief in whose jealousy, the world over, gave rise to hero-cults, that is, "appeasement of souls cut off by misadventure in their prime and believed to be envious of their survivors."[5] Similar were the cults of martyrs[6] and of criminals;[7] and the like belief may have caused the "murder-stones" and cairns of loose rocks where some one had died by violence.[8] Most envious of all, however, were the spirits of fetuses who, not having had any fair chance for life on earth, were naturally resentful toward those enjoying better fortune, manifested especially by inflicting disease upon some relative, "because, not having lived long enough on earth to form attachments to their living relations, they were less likely to show mercy."[9] Far away from modern New Zealand[10] is ancient Egypt's gilded mummy which Pierre Loti graphically describes thus: "On a table in the middle of one of the rooms, a thing to make you shudder gleams in a glass box, a fragile thing that failed of life some two thousand years ago. It is the mummy of a human embryo, and some one, to appease the malice of the born-dead thing, had covered its face with a coating of gold—for, according to the belief of the Egyptians, these little abortions became the evil genii of their families if proper honor was not paid to them. At the

[1]The Golden Bough (J. G. Frazer) ed. 3, viii, 36-37; ibid., ix, 93, 98.
[2]Dread of evil spirits is generally gone from modern culture, see Proceedings of Charaka Club, 1916, iv, 5; why, a problem for psychologists, (E. C. Parsons), Psychoanalytic Review, 1916, iii, 291.
[3](J. A. Scott) Classical Journal, 1914-15, x, 271-272; ibid., 1918, xiii, 372.
[4](T. Reinach) note in Revue Critique, March 18, 1916, p. 192.
[5]Folk-Lore, 1917, xxviii, 279-294, at 285-286.
[6]Compare Tertullian's Invidia of the Martyrs, Expositor, July, 1919, at 33, end.
[7]Cult of Executed Criminals at Palermo (E. S. Hartland) Folk-Lore, 1910, xxi, 167-179, at 178.
[8]Passim in Notes and Queries (London), e.g., 12 Series, v, 188. And so generally, Golden Bough, ix, 21; Popular Religion and Folk-Lore of India, (W. Crooke, 1896 ed.) i, 235.
[9]Maori Religion and Mythology (E. Shortland), 31, 107-108. Compare, as to spirits of own family, Golden Bough, vi, 188.
[10](E. Tregear) Journal of the Polynesian Society, 1917, xxvi, 87-88.

end of its negligible body, the gilded head with its great fetus eyes, is unforgettable for its suffering ugliness, for its frustrated and ferocious expression."[11] The same fear, which Loti sets out, doubtless caused the preservation of a prehistoric (probably paleolithic) fetus in a Syrian grotto.[12]

The Maori's (New Zealand) belief in the malignant evil spirit of the dead fetus may arise from the latter having had no soul and so being especially liable to carry off souls of survivors;[13] the disastrous consequences of its death while in this soulless condition were avoided in Old Calabar, by giving abortives as tests, early in the pregnancy.[14] "Saxon Leechdoms"[15] also gave directions for removing a dead fetus; but removing a living fetus, for uses in magic, seems still to be frequent in India.[16] That the fetus has a will of its own was believed in France not long ago[17] and forms the basis of obstetrical practice in China,[18] and in sundry places where (it is thought) the time of delivery is at the option of the fetus and where it must be starved, or frightened, out.[19] The Maori belief that the parent of such an ill-shaped creature (as a fetus) is a shark or lizard,[20] appears in more extended form among some of our own countrymen, their belief having been written upon by a Massachusetts lady.[21] A similar fear of the fetus is extant in Europe today; for instance in Maestricht where one of "the names to fearen babes withal"[22] is that of "Gerritje ongeboren" (little Girard who has not been born);[23] so in the Shetlands, from a parallel cause, work is suspended on St. Thomas' Day, December 21;[24] it of course not being now understood there of whom Thomas was a twin,[25] and that one of twins, as also a prematurely-born fetus, in various parts of the world should be exposed for destruction, while special purification is required by the mother.[26] That she (after miscarriage or delivery of a stillborn child) is dangerous in high degree, many primitive peoples believe; if she conceals it,[27] disaster is brought to her family or to the whole tribe,[28] doubtless because the fetus-demon can then not be duly exorcised. The methods of preventing such "revenants" cover too much ground for discussion here, except in the cases of *fetus in utero;* viz.,

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[11]Egypt (La Mort de Philae) (by Pierre Loti, translated . . . . W. P. Baines) at 49; in the original, 54-55.
[12]L'Anthropologie, 1900, xi, 781, quoting Lyon Médical, (no date).
[13]See Golden Bough, viii, 97 and 102; ix, 261-262. Compare (s. v. Abortions) Semitic Magic (R. C. Thompson, 1908) 20, 21, 23; and Tales * * * Eskimo. (Rink, 1875) xlv, 439f. cited in Encyclopaedia of Religion and Ethics (ed. Hastings, et al., 1914) vi, at 55, end.
[14]Labor among Primitive Peoples (G. J. Engelmann, 3d. ed.) 2.
[15]Leechdoms, Wortcunning and Starcraft of Early England (ed. O. Cockayne) i, 29, 39, 362-363.
[16]Omens and Superstitions of Southern India (E. Thurston) 224-229.
[17]Labor among Primitive Peoples (G. J. Engelmann) 7.
[18]Ibid., 6-7 (as translated and ed. by Rodet) 335-359.
[19]Ibid., 6, 20, end.
[20]Maori Religion and Mythology (E. Shortland) 18.
[21]Hawaiian Shark Aumakua (M. A. Beckwith) American Anthropologist, 1917, xix, 505-517.
[22]Names Terrible to Children, a long but incomplete series, in (London) Notes and Queries, at and prior to, 11 Series, ii, 133.
[23]Revue des Traditions Populaires, 1917, xxxii, 223.
[24]See Folk-Lore, 1917, xxviii, at 304.
[25]That is, Jesus; see Boanerges (J. R. Harris) 245-246, *et passim;* but the intended elaboration thereon in India, was interrupted indefinitely in consequence of the learned author's being submarined twice.
[26]Golden Bough, iii, 286, and 286-7, note[6].
[27]"If the woman should conceal from the other people that she has had a premature birth . . . the standard of conduct is shifted from a natural to a supernatural basis; . . . the will of God tends to supercede the wishes, real or imaginary, of purely natural beings." Golden Bough, iii, 213-214.
For confession is like a spiritual purge, ibid., 214-219.
[28]Ibid., iii, 140; 152-155, 211.

"Among the Kei Islanders, if a woman dies in child-bed, they kill the unborn babe, to prevent the woman becoming a *Pontianak*, in which case she would haunt her husband and emasculate him."[29] Far nearer to us, in every way, is "The universal belief of Galician Jews that no dead pregnant woman should be buried with child within. That would mean a great danger to the town in which it happened. So when such a case occurs, all means are taken to abstract the child from the body of its mother."[30] This cause-and-effect I felt sure about but never expected to find it thus exemplified; it seems to bring into today's life the reason for that operation among the ancient Hebrews[31,32] which has long stood unexplained in the history of the cesarean section. This history has been written in a skeptical spirit, possibly as a consequence of the heavy percentage of cesarean mortality, almost into our time. In view of the numerous representations in the arts[33,34] and of incidental notices,[35] it seems probable that the Greeks and Romans were more successful in performing the cesarean section than were our ancestors; this is the more likely because of the surprising finds of such operations in Africa.[36,37] That the child was extracted from the dead mother on magical grounds was doubtless the reason for the Roman *Lex Regia* which comes to us from very early times.[38] This law puzzled a famous surgeon-theologian-inquisitor of the Church in explaining in his *Sacra Embryologia*[39] how the practice as to baptism, as set out in the *Rituale Romanum*,[40] coincided in effect with that coming *"ab antiquis Romanis, quamquam Idololatris et nihil de Baptismate cogitantibus."* This can properly be explained by remembering that ancient Rome was a regular fossil-bed of primitive beliefs and practices;[41] so (the Romans of all epochs being singularly conservative) it would be strange indeed if so important a practice should not have survived. Only a small shift in view was needed and this in line with other analogues to "Sin-eating" as noted by Frazer: "The original intention of such practices was perhaps not so much to take away the sins of the deceased as to rid the survivors of the pollution of death."[42]

All necessary was to fix the time for the soul's entering the fetus (say at forty or eighty days of pregnancy),[43] and to direct attention

[29]Mystic Rose . . . (A. E. Crawley), 73.
[30]Translation of (S. Rubin) Der Urquell, 1897, n.f. i, 270.
[31]"Nothing more or less than the classical Cesarean section:" Embryology and Obstetrics in ancient Hebrew Literature (D. I. Macht) Johns Hopkins Hospital Bulletin, 1911, xxii, 143-146 at 145.
[32]But see more extended discussion in Biblisch-talmudische Medizin (J. Preuss, 1911) at 490-498, 698-700.
[33]L'operation césarienne dans l'art, Chronique Médicale, 1910, xvii, 1785; (and 1908, xv, at 149-150).
[34]Der Kaiserschnitt nach den ältesten Überlieferungen unter Zugrundelegung von 18 Geburtsdarstellungen, (F. Weindler) Janus, 1915, xx, 1-40.
[35]E. G., Across a Gap of 2,000 Years (A. Ela) Jour. Am. Veterinary Med. Assn., 1916, n. s. i, 650.
[36]Notes on Labor in Central Africa (R. W. Felkin) Edinburgh Med. Jour., 1883-4, xxix, 922-930, at 928-929, and plates.
[37]L'âme d'un peuple africain, les bambara (Joseph Henry) 225, (non vidi); Mit Emin Pascha ins Herz von Afrika. (F. Stuhlmann, 1894) 82, 184, 391, 625, 674, 724.
[38]Numa Pompilius; "Negat lex regia mulierem, quae praegnans mortua sit, humari, antequam partus ei excidatur: qui contra fecerit, spem animantis cum gravida peremisse videtur." Digesta, i, xi, t. 8 (ed. T. Mommsen, 1902, i, 158).
[39]Theologie und Geburtshilfe nach F. E. Cangiamila's Sacra Embryologia (editio Latina, MDCCLXIV) mit aktuellen Bemerkungen (L. Knapp, 1908).
[40]Ibid., at 72: "Si mater praegnans fuerit, foetus quam primum caute extrahatur, ac si vivus fuerit, baptizetur."
[41]See Golden Bough, ix, 234; and Religious Life of Ancient Rome (J. B. Carter) 5.
[42]Golden Bough, ix, 46, footnote[2] end.
[43]Archiv für Kriminal-Anthropologie und Kriminalistik, 1914, lx, 330; this question has a very great literature (J. Preuss in Biblisch-talmudische Medizin at 450); discussion, with some new light thereon, is postponed.

toward saving this immortal soul rather than toward what injury it might do the survivors. This gave rise to the new[44] theory of the rights of the unborn child as a separate creature,[45] which were discussed in connection with abortion, cesarean section and, later, in "the great debate as to intrauterine baptism."[46] The doctors of the Sorbonne finally decided that such baptism even by midwives is valid,[47] and special apparatus to administer such was made and can be seen depicted.[48,49] As the Church is opposed to craniotomy[50] and other killing of the unborn,[51] so (for the purpose of the child's baptism) it enjoined performance of the cesarean section if the mother be dead; this command was enforced on the physician, by the Civil Arm, under penalties even reaching death. Whether it is his duty to operate on the living mother (who has had the sacraments) with or without her consent, is still a matter of controversy.[52]

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[44]Infant-baptism was not usual among the early Christians (M. Höfler in Archiv für Religionswissenschaft, 1909, xii, at 353, end), before the fifth century (Evolution of Infant Baptism, Tymms, 1912, non vidi), after the Roman influence had loomed larger in comparison with the Jewish and Greek.

[45]See Encyclopaedia of Religion and Ethics, vi, 56; Medical Record, Jan. 8, 1919, 108, end; Alienist and Neurologist, 1911, xxxii, 262-273.

[46]Die Medizin in der klassischen Malerei (E. Holländer), 240, end.

[47]L'Art d'Accoucher (J. Astruc, 1785) 336-341; 327-335.
Fuller details in Histoire des Accouchements chez tous les peuples (G-J-A. Witkowski, 1887 ed.) 141-144.

[48]Ibid.: Appendice: L'Arsenal Obstétrical, 47-48; text, 145-146.

[49]An instrument for the baptism of children before birth (H. M. B. Moens) Med. Rev. of Rev., Oct., 1919, xxv, 622-624, seems to be the result of a ghastly hoax gulped by a traveler blinded by religious prejudice; see L'Arsenal Obstétrical, 29-35, devices depicted under heading: Accouchement prématuré artificiel et avortement provoqué. Investigation is under way, at the place of the alleged occurrence, to ascertain whether his error was the result of such a hoax, of his misunderstanding explanations in a tongue unfamiliar to him, or of what.

[50]Ecclesiastical Review, 1895, xiii, 128; see its index as to all the points herein touched, as also Das Kind (Ploss-Renz), and Das Weib (Ploss-Bartels) *passim*.

[51]Ethics of Medical Homicide and Mutilation (A. O'Malley), *passim;* this book, published under archepiscopal sanction after this article was typed, agrees with many details herein.

[52]See, as to this whole part of the subject, these good items: Histoire des Accouchements . . . (Witkowski) 147-148; Address on the administration of baptism, delivered before the Guild of Sts. Luke, Cosmas and Damian. . . . (A. J. Schulte, 1915); Med. and Surg., 1917, i, at 143-144; Discussion on legal aspects of postmortem Cesarean section (C-W. Whiteside) Am. Jour. Obst., 1916, lxxiii, 1051-1058, 1126-1127; Postmortem Cesarean Section (O. G. Pfaff), ibid., 1916, lxxiv, 967-970, 970-972; Same in Tr. Am. Assn. Obst. and Gynec., 1916, xxix, 42-45, 45-47; (G. Linzenmeier) in Med. Klin., 1920, xvi, 439-442.
The diminishing chances of the child's survival and its lessened legal rights (and especially such of the widower), if extraction be delayed till death of the mother, are questions, interesting indeed, but not germane.

Selected Abstracts

General Problems of Obstetrics

Herbert R. Spencer: William Harvey, Obstetric Physician and Gynecologist. British Medical Journal, 1921, No. 3173, p. 621.

The author gives a brief sketch of William Harvey and some of his work. He also considers the contribution of 16th century Paduan teachers of obstetrics and gynecology, discussing the status of obstetrical work in the 16th and 17th centuries. The paper contains interesting pictures of the frontispiece of Harvey's "De Generatione Animalium"; the facade of the university building at Padua; the title page of Mercurio's "La Comare", and the illustration of a Cæsarean Section from the same work. There is also a print of the Canterbury portrait of William Harvey. Quotations are given from the Medical Observations of Harvey which deserve careful consideration at the present time. Following some remarks

on the management of ordinary labor in which he advocates patience and gentleness in imitation of Nature, which "is a perfect operatrix" Harvey says, "if you carefully ponder Nature's works, you shall find none of them made in vain, but all directed to some end and some good".—F. L. ADAIR.

Keukenschriever and Doorenbos: Parturition in Javanese Women. General Tijdschrift voor Nederlandsch Indie, Abstr. Nederlandsch Tijdschrift voor Geneeskunde, 1922, i, 403.

It is always of interest to compare labor in women who have been under the influence of civilization for only a short time with the same process in European women. It is for this reason that the above authors made careful notes of 1,000 native women delivered in a hospital in Java.

In the series there were three deaths, two from eclampsia and one from malaria. In only four cases were forceps applied. The number of stillborn children amounted to 3.73%. Twins occurred once in every 180 cases. In only two out of 400 patients in whom the urine was examined were traces of albumin found. Placenta previa occurred only three times and in these, delivery was spontaneous after rupturing the membranes. In 16% of the patients the temperature rose above 38°C. due to malaria or infections, none of which were serious. Pyelonephritis and phlebitis were not encountered. Since all syphilitic patients are registered in the islands, syphilitic mothers are treated early, therefore there were no syphilitic children.

The average weight of the infants was 2,797 gm. as against 3,500 in European children. The authors found that the infants' weight was greater in those cases where the women spent some time in the hospital previous to delivery.

The internal pelvic measurements corresponded closely to those of European women, while the external measurements were less, owing to the finer bone structure of the Javanese.—R. E. WOBUS.

Salesby: The Antenatal Factors of Life and Death—Genetic, Toxigenetic, Gestational and Obstetrical. New York Med. Journal, 1921, cxiv, 413.

The author subjects to a critical review the theory of a certain school of eugenists, who maintain that infant mortality is an illustration of natural selection, that it weeds out the unfit and that to attempt to correct it, is to arrive at racial degeneracy. A study of the causes of death among infants reveals the fact that the solitary instance in which true heredity may be considered a factor—in which death is due to the intrinsic transmission of something in the germ-cells—is hemophilia. The disease, aside from being so rare that it is of no statistical importance, runs contrary to the principle of natural selection, since the female who transmits the disease does not die, but survives to transmit it to her own sons. While true heredity then is negligible in infant mortality and the natural selection theory is baseless, there are a number of antenatal factors of the greatest importance. These include the racial poisons, alcohol and syphilis. Upon the protection of youth and adolescence from these, and upon perfect nutrition and the complete and continuous protection of the expectant mother from intoxication and infection must depend our efforts to save the baby and improve the race.—MARGARET SCHULZE.

Ley: Difficulties Encountered in Pregnancy, Labor and Lactation in Working Class Mothers and Those of the Educated Classes. New York Medical Journal, 1921, cxiv, 412.

The author finds that the minor discomforts of pregnancy are noted far less by the educated classes; probably largely because they observe more carefully the rules of hygiene. They also approach labor and endure its earlier stages with more equanimity, but later demand an anesthetic. The lower classes usually approach

labor with fear and do not realize the possibility of relief. Minor difficulties in labor are more common among the upper classes, while major difficulties are extremely rare, since pelvic deformity is almost unknown among the upper classes. Inability to nurse the child due to an insufficient supply of milk is far more common among the upper classes although the mother may desire to nurse it.—MARGARET SCHULZE.

Taylor: Prenatal and Obstetric Care. Pennsylvania Medical Journal, 1921, xxv, 39.

The author presents a considerable group of well selected statistics to show the fallacy of considering pregnancy a harmless physiological process. That the majority of deaths incident to childbirth are preventable by proper prenatal and obstetric care has been proved. The routine employed in the prenatal clinic of the Altoona Hospital is given in detail. The physician gives each prospective mother a booklet containing the information about her care that should come from him instead of the babbling neighbors.—H. W. SHUTTER.

Cumpston: The Effect of Legislature Control on the Incidence of Antenatal Syphilis. Medical Journal of Australia, 1921, ii, 133.

Only through a study of accurate statistical data can the effects of legislation for the control of venereal diseases be determined. Reliable statistics are available only so far as antenatal infection is concerned. Two tables are presented showing the mortality figures for a period of ten years, during which the statutes have been in operation. The tables deal with the mortality in the first month and in the first three months respectively.

Scrutinity of these tables demonstrates that no State shows any improvement throughout the period. This would seem to show that either the mortality at the ages under discussion is not the result of venereal infection or the measures now in operation against venereal diseases are not favorably affecting mortality from congenital venereal infections. To better this situation the author suggests the following administrative measures: (1) Routine examination of the wife (or husband) and children of the syphilitic; (2) Routine examination of every pregnant woman (which involves compulsory notification of pregnancy) and a proper origination to insure antenatal examination; and (3) The provision of facilities, at strategic points, for effective prophylaxis for immediate application after exposure to infection.—NORMAN F. MILLER.

Couvelaire: A Dispensary for Syphilis as Part of a Maternity Service. Gynécologie et Obstétrique, 1921, iv, 9.

The necessity of some provision for the proper care of syphilitics seemed evident to Couvelaire when he found that in the Maternité Baudeloque lues seemed evidently responsible for at least one half of the fetal deaths after the sixth month of pregnancy, and for about 20 per cent of the deaths of feeble infants within the first ten days of life. He created a special dispensary under the joint supervision of a syphilographer and an obstetrician who in 1920 cared for 700 syphilitic mothers and 125 babies. The efforts of the dispensary to a large extent are also educational, and most tactfully contact is established with the rest of the family of every syphilitic baby met in the service—R. T. LAVAKE.

Sequiera: The Dangers and Treatment of Antenatal Syphilitic Environment. New York Medical Journal, 1921, cxiv, 415.

Syphilis is a most important factor in the production of premature births, still births and infant mortality. The statistics of Williams, of the Royal Commission on Venereal Diseases of England, of Watson at Glasgow and of Epstein at Prague all emphasize this point. Yet the treatment of the mother by salvarsan and its

allies while the fetus is still in utero is remarkably efficient. Statistics vary from 90% to 100% of healthy babies born to treated syphilitic mothers. It is, therefore, most important to impress upon the public that no person who has contracted syphilis, should marry while likely to infect the other partner. Energetic treatment of the syphilitic pregnant woman must begin at once, no matter what the stage of the pregnancy. If a child is brought to a clinic suffering from congenital syphilis, the parents should be seen and, if necessary, treated, and if possible, all the other children should also be examined. In this way, we may hope for the gradual disappearance of a grave menace to life and health.—MARGARET SCHULZE.

Bell, W. Blair: Some Common, but often Unrecognized, Obstetrical Difficulties. British Medical Journal, 1921, No. 3171, 545.

The author calls attention to occipito-posterior positions and emphasizes the possibility of their manual correction. He discusses postmaturity and advises the induction of labor when it is definitely evident that 40 weeks have elapsed. For this purpose he advises intramuscular injection of infundibulin, night and morning, for three days. If this is unsuccessful he uses uterine bougies. The milder grades of pelvic deformities are the ones most frequently overlooked, nonrachitic, flat, generally flat and funnel pelves. He mentions the possibility of diagnosing atonicity of the uterus before labor by failure to react to manipulation during the latter weeks of pregnancy; also by a systolic blood pressure of 110 mm. or less in the latter weeks of pregnancy. This may be overcome and primary uterine inertia avoided by the administration of calcium. He advises a preparation containing pure lactic acid (200 grains), precipitated calcium carbonate (75 grains), and chloroform water (8 ounces). Two ounces of this should be given every night. In addition infundibulin (0.5 c.cm.) may be injected every night and morning for a couple of weeks.—F. L. ADAIR.

Arnold: A Brief Review of Recent Obstetrical Progress. New York Medical Journal, 1921, cxiv, 405.

The science of obstetrics, and perhaps the practical part as done in the better class of institutions throughout the country, shows very decided gains in the last twenty-five years. Yet the great proportion of practical obstetrics is not done in suitably equipped institutions and the mortality and morbidity rates the country over have shown practically no improvement during this period. Statistics for the country at large show that among women of child bearing age, childbirth is second only to tuberculosis as the cause of the greatest number of deaths, that one woman of every 140 who become pregnant dies as a direct result of pregnancy or labor and that one child of every twenty-five dies during the process of birth or as a direct result of that process. The great need is for the application of our knowledge in the domain of practical obstetrics.

Eclampsia may be largely prevented by careful prenatal care. Fetal mortality and maternal morbidity may be greatly reduced by careful diagnosis of the exact relationship in presentation, position and size of the child and the birth canal and by the systematic use of the labor stethoscope. In the treatment of asphyxiated babies, vigorous and violent methods of resuscitation have been replaced by the aspirator, which is all that is needed except in asphyxia pallida. The routine use of pituitrin in the third stage of labor is helpful as blood saving procedure.

Morphine and scopolamine lessen the severity and usually the length of the first stage of labor. The second stage is then terminated artificially under anesthesia, either by the Potter version or a prophylactic forceps operation. A wide episiotomy is done to save the pelvic floor, and is later accurately repaired. This method of delivery conserves the mother's strength. It shortens convalescence,

saves the pelvic floor and avoids the dangers of prolonged compression to the baby's brain.—MARGARET SCHULZE.

McKeown: Present Day Obstetrics. Journal of the Kansas Medical Society, 1921, xxi, 320.

The writer advocates advice to mothers; aseptic surgical technic; proper diagnosis; great care of the newborn and special care in all pathological cases, and also discusses episiotomy, version, and cesarean section.—W. K. FOSTER.

Rucker and Haskell: The Dangers of Pituitary Extract: Some Clinical and Experimental Observations. Journal American Medical Association, 1921, lxxvi, 1390.

Supplementing the observations of other obstetricians, Rucker and Haskell find that the use of pituitary extract is responsible for occasional uterine rupture, and definitely increases the frequency of perineal lacerations even in cases where its use is indicated. In the child, asphyxiation and intracranial hemorrhage are more frequent. In experimental animals and, at times, in human beings, the drug causes tetany of the uterus.

In view of the definite danger of even "safe" doses, they feel its use should be discouraged.—R. E. WOBUS.

Schmitt: The Conduct of Labor in Contracted Pelves. Zeitschrift für Geburtshilfe und Gynäkologie, 1921, lxxxiii, 366.

The author considers the conduct of labor in the 538 cases of contracted pelves observed in the second 10,000 deliveries in the Würzburg clinic from 1907 to 1919. Direct measurements by Bylicki's method were employed. Since this is no longer applicable following engagement of the head, many cases of spontaneous labor with mild degrees of pelvic contraction necessarily are omitted from these statistics. This explains the rather low percentage of spontaneous deliveries, 215 or 54.9 per cent of 392 cases of head presentation with a fetal mortality of 4 or 1.02 per cent. Two mothers died, following spontaneous delivery from causes which could not be related to the pelvic contraction.

Breech presentations were encountered in 19 cases or 3.6 per cent of the total number. Three children, or 15.7 per cent of this series died but there was no maternal mortality. Transverse presentations were found in 98 cases or 18.8 per cent of the total number. Three were in primiparae, the rest in multiparae. Sixteen children died or 16.3 per cent. One mother died of dysentery three weeks after labor.

One hundred seventy-seven cases, or 45.1 per cent, were delivered by operation. Version and extraction was employed 28 times, or in 7.1 per cent of cases. Twelve children died, or 47.1 per cent. High forceps were used 24 times with a fetal mortality of 20.8 per cent. The maternal mortality in both these series was 0. Premature labor was induced 63 times. Thirteen children died, 11 were stillborn, the other 2 died within 2 weeks. One mother died 3 weeks postpartum, the case of dysentery mentioned under transverse presentation. Perforation was employed 32 times; twice on the living child, 22 times on the advancing, 10 times on the after-coming head. Two mothers died, both cases of uterine rupture which had occurred before entry; 92 cesarean sections were performed; 32 of those were repeated cesareans; 23 were performed after rupture of the membranes, in 15 cases shortly after, in the rest from 24 hours to 8 days after rupture of membranes. Two cases were Porro operations which survived, of the others, clean cases were operated by the transperitoneal cervical section, infected or suspicious cases by the extraperitoneal section. There were 2 deaths or 2.17 per cent. There were no complications in any of the other cases, not even a wound infection. All the children were born alive, but 3 died in the first few days, or 3.3 per cent.

Bone-splitting operations were employed in only 4 cases, of which all the children and all the mothers lived, but one mother had a thrombosis and a fistula leading to bone, with a very protracted convalescence.

Prolapsed cord occurred in 28, or 7.27 per cent, of the cephalic presentations as opposed to the general incidence of 1.08 per cent in the total of 10,000 cases. 57.1 per cent of these children died.

The total maternal mortality was 7, or 1.33 per cent, the corrected maternal mortality 3, or 0.57 per cent, of whom one woman died of sepsis after a normal labor and 2 died of sepsis after cesarean section. The total fetal mortality was 10.2 per cent at birth, 11.21 per cent including the cases which died in the first few days after labor.—MARGARET SCHULZE.

Browne: Stillbirth: Its Causes, Pathology and Prevention. British Medical Journal, 1921, No. 3161, p. 140.

The article is based on a study of 200 consecutive cases of stillbirth (120) and neonatal death (80). There were 19 craniotomies, 3 on the aftercoming head. Of the stillbirths 49 or 40 per cent were attributed to antepartum asphyxia. Also in 15 of the craniotomy cases death was probably due to asphyxia. The corrected figures would be 64 cases or 53 per cent. The contributory causes of death were placenta previa, accidental hemorrhage, and eclampsia. The chief causes of intrapartum asphyxia were disproportion between the head and the pelvis, primiparity, prolapsed cord and difficulty with the after-coming head. Of the 38 cases of intrapartum asphyxia 11 were breech presentations. Postmortem findings are described in detail. Cerebral hemorrhage was present in 29.5 per cent. Of these 20 were breech and 39 were vertex cases. In the cases of hemorrhage tearing of the tentorium cerebelli was present in 37 per cent, 63 per cent of these were breech cases. There were 22 cases with intraventricular hemorrhage. Of all the cases with tears of the dural septa 60 per cent were unassociated with cerebral hemorrhage. There were 35 cases of syphilis including 14 macerated fetuses. Pneumonia during the first week accounted for 26 per cent of the neonatal deaths. The author describes the pneumonia as acute hemorrhagic pneumonia of infants. He found 18 cases of suprarenal hemorrhage. Out of 200 babies 95 were born prematurely. The causes for it in order of frequency were: syphilis 28; multiple pregnancy 16; induction of labor 12; eclampsia 11; placenta previa 8. Of the premature infants 56 died in the neonatal period. Causes were: cerebral hemorrhage in 22 cases; syphilis in 12; syphilis with pneumonia in 6. The author attributes 3 deaths to twilight sleep. There were also other miscellaneous causes. The author emphasizes the necessity for expert supervision during pregnancy. Only 3 per cent of the 200 cases had received adequate antenatal care. He advocates either voluntary or compulsory notification of pregnancy.—F. L. ADAIR.

Polak: The Defects in Our Obstetric Teaching. Journal American Medical Association, 1921, lxxvi, 1809.

While the mortality from practically all diseases has been reduced, Polak finds that the statistics not only do not show a decrease but a very definite increase in the mortality from childbirth in the U. S. from 1902 to 1919. There have been approximately three times as many deaths from sepsis, four times as many from eclampsia, and twice as many from other obstetrical causes as seventeen years ago. This, he thinks, is due to the relatively poor training of the medical student in the practice of obstetrics. He feels there should be more uniformity in the teaching of the fundamentals of obstetrics and that greater emphasis should be laid upon the responsibility of the obstetrician for the lives of both mother and child.—R. E. WOBUS.

Bourne: The Causation and Prevention of Puerperal Sepsis. The Clinical Journal, (London) 1921, 1, 456.

Despite the apparent advance of sepsis in obstetrics the proportion of deaths from septicemia was exactly the same in 1917 as in 1857. Two factors enter into the production of puerperal fever, (1) the implantation of microbes directly on the placental site; (2) the diminished resistance of the patient against their growth and spread. Sporadic cases of sepsis occur even when all precautions have been used, and when no examinations have been made. Out of 43 cases with a severe, purulent vaginal discharge prenatally, 15 cases had a febrile puerperium, 2 cases being serious. This would lead to the conclusion, that in about a third of the cases with a preexisting infection of the cervix as evidenced by the vaginal discharge, the organisms may ascend into the uterus and cause puerperal fever. Of the last 15 cases of septicemia, at the Queen Charlotte Hospital, London, 8 cases had severe postpartum hemorrhages and in 6 cases the placenta had been removed manually. This means that two of the most favorable conditions for leading to sepsis were present, namely, lowered resistance from hemorrhage and the possibility of direct transference to the placental site of organisms by the hand of the operator. Of 154 cases of manual removal of the placenta 54, or 35%, developed some form of uterine sepsis. The prevention of puerperal sepsis consists in the adequate preparation of the patient and operator, a prenatal attempt to clear up any vaginal discharge, care against postpartum hemorrhage, judgment in manually removing the placenta, and the immediate suturing of perineal wounds. —A. C. WILLIAMSON.

Bell, W. Blair: The Prevention and Treatment of Puerperal Infections. British Medical Journal, May 14, 1921, i, 693.

According to the Registrar-General's statistics the mortality from puerperal infection now is greater than for any previous year for fourteen years. The author thinks the cause of this is due partly to unnecessary interference. He deplores the too frequent use of forceps. Natural defences against infection are: (1) The general condition of the patient, (2) the normal acid secretion of the vagina, (3) the so-called physiologic leucocytosis occurring toward the end of pregnancy. The points of entry of infection are the placental site and any laceration of the tissues. The promotion of healing by first intention of all lacerations, especially of the perineum, should be secured by appropriate suturing.

His general conclusions are as follows: (1) Puerperal infection must be recognized as largely an avoidable disease. (2) The remedy is in the better application of principles of asepsis and antisepsis. (3) Rectal examination should be substituted for vaginal examination of parturient women in so far as is possible. (4) All lacerations of the perineum should be carefully sutured. (5) Care should be taken in maintaining the natural defences of the patient. In regard to the treatment of puerperal infection the author advocates (1) the early removal of large pieces of placenta with antiseptic irrigation of the uterus; (2) autogenous vaccines and polyvalent serums for general infection; (3) major operations such as ligation of veins in puerperal thrombo-phlebitis. He also suggests (1) the investigation of general and local defences of infection; (2) more appropriate institutional care of the cases of puerperal infection in special wards; (3) the supply of sterile obstetrical outfits for the poor; (4) better organization for the handling of obstetrical cases.—F. L. ADAIR.

Schmitt: The Prevention of Puerperal Fever. Zeitschrift für Geburtshilfe und Gynäkologie, 1921, lxxxiii, 335.

The author gives the morbidity statistics for the second 10,000 labors in the Würzburg clinic, from 1907 to 1919 The list includes 4492 primiparae and 5508

multiparae. Of these cases 17.08 per cent required operative intervention of some type or showed severe obstetrical complications.

The total morbidity was 8.8 per cent, including all cases in which the axillary temperature touched or exceeded 38° C. The "puerperal morbidity" was 3.49 per cent and included all cases in which the fever could not definitely be ascribed to some extragenital cause. The author does not regard bacteriological examination of the lochia as of value in determining which cases of fever are due to puerperal infection, since it is impossible to determine which organisms are pathogenic and which are saprophytic.

Severe disturbances, including cases in which the fever reached or exceeded 39° C., are recorded in .71 per cent, and of these, 15 or .15 per cent died. Only 5 of the labors of these 15 cases were conducted entirely in the clinic, and in 2 of the 5 cases, postmortem examination indicated that the sepsis was of tonsillar rather than puerperal origin. Of the 3 cases in which a fatal infection was acquired in the clinic, one followed a manual removal of the placenta and two a normal labor.

Cases in this clinic are conducted with repeated vaginal examinations by physicians, students, and midwife students, with a careful aseptic technic, though in most cases without gloves; and the author believes the results justify a continuation of the procedure rather than an adoption of routine rectal examinations. Routine preliminary vaginal disinfection is also employed, since it is impossible to determine whether or not the vaginal organisms present are pathogenic. The author does not state what germicidal agent is employed. In a short space of time from October 1, 1909 to April 1, 1911, in which this preliminary vaginal douching was omitted, two cases of fatal sepsis following normal spontaneous labor occurred, and although these were presumably of tonsillar origin, it was deemed wise to return to the old routine.—MARGARET SCHULZE.

Fagge: Circumcision. The Clinical Journal, (London) 1921, 1, 593.

The routine circumcision of every male child is condemned. An occasional death from sepsis or hemorrhage cannot be prevented. The writer feels that insufficient evidence has been presented to prove that circumcision prevents enuresis, hernia, convulsions or any of the other numerous ills attributed to the foreskin. He has never seen any figures to shows that there is less venereal infection or masturbation among the circumcised than the uncircumcised. The foreskin does not naturally retract from the glans until at the time of puberty, and merely because it will not retract before that time, due to adhesions, is no reason for removing it. If the prepuce is redundant so that there is definite uncleanliness; if there is a phimosis or definite interference with urination, circumcision is justifiable and should be done as carefully as any other surgical operation.—A. C. WILLIAMSON.

Book Reviews

Diagnostische und therapeutische Irrtümer und deren Verhütung in der Frauenheilkunde.—Herausgegeben von Professor Dr. J. Schwalbe, im Verlage von Georg Thieme, Leipzig.

This new publication, appearing in the form of small monographs, is based on the truism that a great deal of our most valuable knowledge and experience we acquire through proper appreciation of our mistakes. A group of prominent German gynecologists have expressed their willingness to discuss selected obstetrical and gynecological topics from this novel point of view. They set forth the most common errors in diagnosis and therapy and suggest the means of preventing such mistakes. So far five of these monographs have appeared: Common Errors in the Management of Labor, by Professor Fehling; Diagnostic Mistakes and Their Prevention in the Management of the Puerperium, by Professor Zangemeister; Diseases of Vulva, Vagina, Bladder, Ureters and Urethra. Gonorrhea, Syphilis and Tuberculosis of the Female Genitalia, by Professor Henkel; Diseases of the Uterus, by Professor Reifferscheid; and Diseases of Ovaries, Tubes, Ligaments, Cellular Tissue and Peritoneum, by Professor von Jaschke.

There is no attempt made in these essays to cover the entire subject in a systematic manner as is done in every standard textbook. They rather supply a large amount of valuable information customarily omitted from the textbook.—H. E.

Les Hémorrhagies Méningées Sous-Dure-Mériennes Traumatiques du Nouveau-Né.—By Pierre Lantuéjoul, Interne des Hôpitaux. Paris, Amédée Legrand, Editeur, 1921.

In this monograph of more than 160 pages the author discusses very thoroughly the problem of intracranial birth hemorrhages of the newborn infant. His conclusions are based on 35 observations of injuries of this sort and a careful study of the entire literature on the subject.

Heart Disease and Pregnancy.—By Sir James Mackenzie, M.D., F.R.C.P., Hon. Consulting Physician to his Majesty the King in Scotland; Director of the Institute for Clinical Research, St. Andrews; Consulting Physician to the Victoria Hospital, Burnley, and the London Hospital, London, Henry Frowde and Hodder & Stoughton. 1921.

It will suffice to call the attention of obstetricians to the fact that this lucid exposition of the inter-relation between heart diseases and pregnancy has appeared in form of a monograph. Readers of our Journal have been offered an exhaustive review of this important contribution by Mackenzie in December, 1921, ii, 659.